



# Pocket Guidelines

Committee for Practice Guidelines  
to improve the quality of clinical practice  
and patient care in GCC countries

Management of Patients with  
Peripheral Arterial Disease

2009

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## INTRODUCTION

Our understanding of lower-extremity arterial occlusive disease and its treatment is evolving at an ever-increasing pace. Simplistic views of the natural history of peripheral arterial disease (PAD), its impact upon the lower extremity, and surgical revascularization for limb salvage have been replaced by a greater understanding of the disparate courses of intermittent claudication, chronic sub critical ischemia, and critical limb ischemia, the development of multispecialty healthcare teams, and a plethora of medical and interventional therapies. With each step forward, more is learned and new challenges are defined. The management of the patient with PAD has to be planned in the context of the epidemiology of the disease, its natural history and, in particular, the modifiable risk factors for the systemic disease as well as those that predict deterioration of the circulation to the limb.

The Gulf Heart Association (GHA) assigned a working group to develop guideline for the management of the PAD in the Gulf Countries. This review has adopted the Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). The text is presented in such a way that vascular specialists will still find most of the information they require, while general practitioners and primary health physicians will easily find guidance for diagnosis and diagnostic procedures, referral of patients and expected outcome of various treatment options.

## DEFINITIONS

### **Intermittent Claudication (IC):**

(Means to limp) which is muscle discomfort in the lower limb reproducibly produced by exercise and relieved by rest within 10 minutes.

### **Critical Limb Ischemia (CLI):**

Is a manifestation of PAD that describes patients with typical chronic ischemic rest or patients with ischemic skin lesions, either ulcers or gangrene. The term CLI should only be used in relation to patients with chronic ischemic disease, defined as the presence of symptoms for more than 2 weeks.

### **Acute Limb Ischemia (ALI)**

Is any sudden decrease in limb perfusion causing a potential threat to limb viability. Presentation is normally up to 2 weeks following the acute event.

## **Epidemiology of Peripheral Arterial Disease**

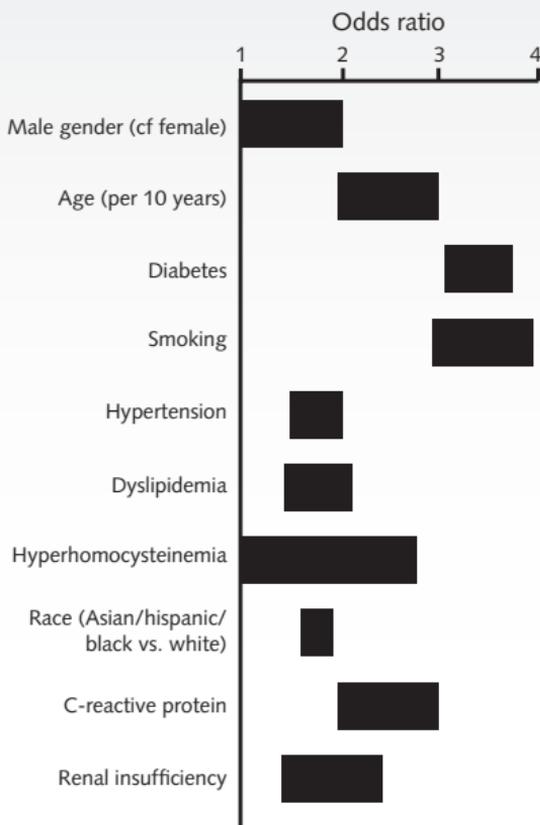
The incidence and prevalence of asymptomatic PAD based on objective testing has been evaluated in several epidemiologic studies and is in the range of 3%-10%, increasing to 15%-20% in persons over 70 years. On the other hand, symptomatic PAD in the form of intermittent claudication (IC) is more difficult to measure but it would appear to increase from about 3% in patients aged 40 to 6% in patients aged 60 years.

### **Risk Factors for PAD**

- Race
- Gender
- Age
- Diabetes mellitus
- Hypertension
- Dyslipidemia
- Smoking
- Hyperhomocysteinemia

- Inflammatory markers [C-reactive protein (CRP)]
- Hyperviscosity and hypercoagulable states
- Chronic renal insufficiency

The influence or the association between the risk factors and the PAD varies and this is summarized graphically in figure 1.



**Fig. 1:** Approximate range of odds ratios for risk factors for symptomatic peripheral arterial disease. Treatment of risk factors and the effect on the outcomes of PAD are described in Chapter B.

The prevalence of cardiovascular risk factors in the Gulf countries has increased; the prevalence of diabetes mellitus is the highest worldwide approaching 25% of the adult population. In 2003, the five countries with the highest diabetes prevalence in the adult population were Nauru (30.2 %), The United Arab Emirates (20.1 %), Qatar (16%), Bahrain (14.9%), and Kuwait (12.8%). More than 70% of the adult population has excess body weight. Twenty six percent of the adult populations are hypertensive, 54% have hypercholesterolemia and from 13 % to 40 % are smokers. The risk factors that favor the development of peripheral arterial atherosclerosis are similar to those that promote the development of coronary atherosclerosis.

## Classification of PAD

Two classification systems have been used for lower extremity PAD: the Fontaine system and the Rutherford system. Both are based upon the severity of symptoms and markers of severe disease such as ulceration and gangrene

Classification of peripheral arterial disease: Fontaine's stages and Rutherford's categories

Fontaine		Rutherford		
Stage	Clinical	Grade	Category	Clinical
I	Asymptomatic	0	0	Asymptomatic
IIa	Mild claudication	I	1	Mild claudication
IIb	Moderate to severe claudication	I	2	Moderate claudication
		I	3	Severe claudication
III	Ischemic rest pain	II	4	Ischemic rest pain
IV	Ulceration or gangrene	III	5	Minor tissue loss
		III	6	Major tissue loss

TASC guidelines contained a new classification system for treatment of peripheral arterial disease. The classification was based upon response to intervention and was independent of technology and techniques. The goal of the TASC classification system was to indicate the best forms of treatment

for patients with symptomatic arterial occlusive disease of the lower extremity, based upon published reports. TASC guidelines divide the peripheral arterial disease into the Aortoiliac lesions and femoral popliteal lesions.

## TASC classification of aorto-iliac lesions

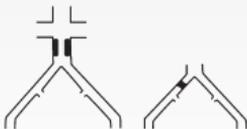
### Type A lesions:

- Unilateral or bilateral stenoses of CIA
- Unilateral or bilateral single short ( 3cm) stenosis of EIA



### Type B lesions:

- Short ( 3cm) stenosis of infrarenal aorta
- Unilateral CIA occlusion
- Single or multiple stenosis totaling 3-10 cm involving the EIA not extending into the CFA
- Unilateral EIA occlusion not involving the origins of internal iliac or CFA



### Type C lesions:

- Bilateral CIA occlusions
- Bilateral EIA stenoses 3-10 cm long not extending into the CFA
- Unilateral EIA stenosis extending into the CFA
- Unilateral EIA occlusion that involves the origins of internal iliac and/or CFA
- Heavily calcified unilateral EIA occlusion with or without involvement of origins of ingins of internal iliac and/or CFA



### Type D lesions:

- Infra-renal aortoiliac occlusion
- Diffuse disease involving the aorta and both iliac arteries requiring treatment
- Diffuse multiple stenoses involving the unilateral CIA, EIA, and CFA
- Unilateral occlusion of both CIA and EIA
- Bilateral occlusions of EIA
- Iliac stenoses in patients with AAA requiring treatment and not amenable to endograft placement or other lesions requiring open aortic or iliac surgery

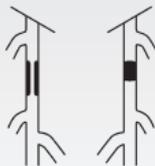


CIA - Common Iliac Artery; EIA - External Iliac Artery; CFA - Common Femoral Artery; AAA- Abdominal Aortic Aneurysm

# TASC classification of femoral popliteal lesions

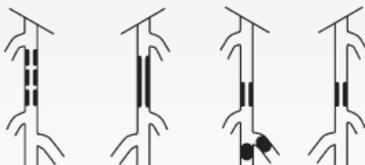
## Type A lesions:

- Single stenosis 10 cm in length
- Single occlusion 5 cm in length



## Type B lesions:

- Multiple lesions (stenoses or occlusions), each
- Unilateral CIA occlusion 15 cm not involving infrageniculate popliteal artery
- Single or multiple lesions in the absence of continuous tibial vessels to improve inflow for a distal bypass
- Heavily calcified occlusion 5 cm in length
- Single popliteal stenosis



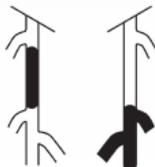
## Type C lesions:

- Multiple stenoses or occlusions totaling > 15 cm with or without heavy calcification
- Recurrent stenoses or occlusions that need treatment after two endovascular interventions



## Type D lesions:

- Chronic total occlusions of CFA or SFA (>20 CM, involving the popliteal artery)
- Chronic total occlusion of popliteal artery and proximal trifurcation vessels

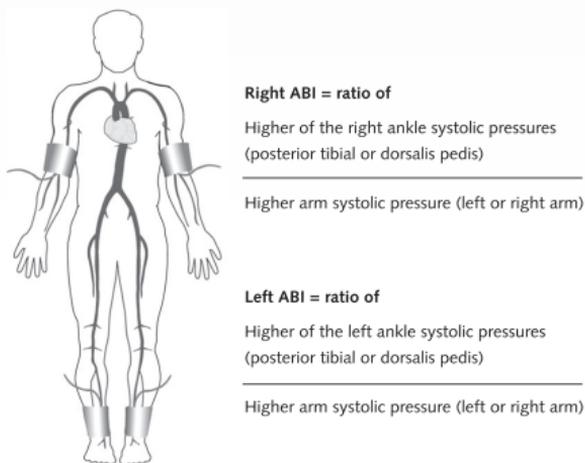


CFA- common femoral artery; SFA- superficial femoral artery

# EVALUATION of PATIENTS with PERIPHERAL ARTERIAL DISEASE

Over 2/3 of the patients with PAD are asymptomatic or have atypical leg symptoms and thus may not be recognized as having a systemic cardiovascular disease. In addition, approximately 1/2 of the patients with PAD have not yet suffered a major cardiovascular event. Therefore, many patients with PAD are not identified, resulting in inadequate identification and treatment of their atherosclerosis risk factors.

The initial clinical assessment for PAD is a history and physical examination. A history of intermittent claudication is useful in raising the suspicion of PAD, a pulse abnormality (absent or diminished) significantly overestimates the true prevalence of PAD. The primary non-invasive screening test for PAD is the ABI (Figure 2).



**Figure 2:** Measurement of the ABI (ABI = Ankle-Brachial Index)

Patients with PAD, defined as an ABI  $\leq 0.90$ , are known to be at high risk for cardiovascular events (Figure 3).

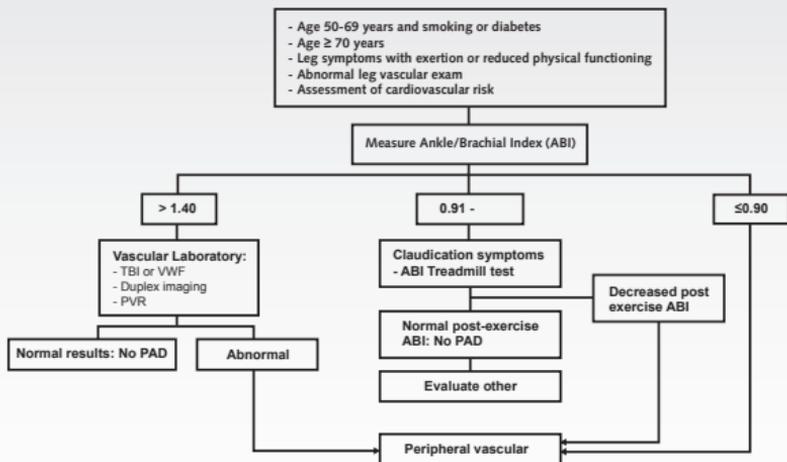


Figure 3: Algorithm for diagnosis of peripheral arterial disease.

## Non-Invasive Vascular Laboratory

### Segmental Limb Systolic Pressure Measurement (SLP):

- Compare limb blood pressures to systemic pressures obtained in arms.
- Normally: systolic pressure (SP) in each limb segment should be equal or greater than arm pressure.
- Significant pressure drop between adjacent segments signals the presence of occlusive disease in that region.
- Limitations:
  - \* Diabetics, renal dialysis patients (falsely elevated pressures incompressible arteries)
  - \* Inability to differentiate between arterial stenosis or occlusion.
  - \* Missing isolated moderate stenosis (usually iliac).

## **Segmental Plethysmography or Pulse Volume Recordings (PVR):**

- A plethysmograph is an instrument that detects and graphically records changes in limb volume
- Used for arteries and veins.
- Limitations:
  - \* SLP and PVR measurements alone are 85% accurate compared with angiography in detecting and localizing significant occlusive lesions.
  - \* When used together, the accuracy approached 95%.

## **Toe Pressures and the Toe-Brachial Index (TBI):**

- Used on patients with incompressible vessels (e.g. Diabetics, chronic renal failure).
- Non-compressible measurements are defined as a very elevated ankle pressure (e.g. 250 mmHg) or ankle-brachial index (ABI)  $>1.40$ .
- In this situation, measurement of toe pressures provides an accurate measurement of distal limb systolic pressures
- False positive results with the TBI are unusual.
- Limitations:
  - \* Main limitation in patients with diabetes is that it may be impossible to measure toe pressure in the first and second toes due to inflammatory lesions, ulceration, or loss of tissue.

## **Doppler Velocity Wave Form analysis:**

- Arterial flow velocity can be assessed using a continuous wave Doppler at multiple sites in the peripheral circulation.
- Doppler waveforms evolve from a normal triphasic pattern to a biphasic and, ultimately, monophasic appearance in those patients with significant peripheral arterial disease (PAD).

- Limitations:
  - \* Operator-dependent,
  - \* Junk Signals: Obesity, scar tissue, occluded artery.
  - \* Venous interference (averaged signal).

## Imaging Techniques

The main reason for imaging is to identify an arterial lesion that is suitable for revascularization with either an endovascular or open surgical technique. The current options for imaging are angiography, duplex ultrasound, MRA and CTA. Potential side effects and contraindications should be considered in choosing the imaging modality. The different imaging methods are compared in Table 1.

**Table 1:** Comparison of different imaging methods

Modality	Availability	Relative risk and complications	Strengths	Weaknesses	Contraindications
X-Ray contrast angiography	Widespread	High Access site complications Contrast nephropathy Radiation exposure	"Established modality"	2D images Limited planes Imaging pedal vessels and collaterals in the setting of occlusion requires prolonged imaging and substantial radiation	Renal insufficiency Contrast allergy
MDCTA	Moderate	Moderate Contrast nephropathy Radiation exposure	Rapid imaging Sub-millimeter voxel resolution 3D volumetric information from axial slices Plaque morphology	Cacium causes "blooming artifact" Stented segments difficult to visualize	Renal insufficiency Contrast allergy

Modality	Availability	Relative risk and complications	Strengths	Weaknesses	Contraindications
MRA	Moderate	None	True 3D imaging modality; Infinite planes and orientations can be constructed Plaque morphology from proximal segments with additional sequences Calcium does not cause artifact	Stents cause artifact but alloys such as nitinol produce minimal artifact	Intracranial devices, spinal stimulators, pace-makers, cochlear implants and intracranial clips and shunts are absolute contraindications
Duplex	Widespread	None	Hemodynamic information	Operator dependent and time consuming to image both lower extremities Calcified segments are difficult to assess	None

MDCTA - Multidetector Computed Tomography Angiography; MRA - Magnetic Resonance Angiography.

## MANAGEMENT OF CARDIOVASCULAR RISK FACTORS AND CO-EXISTING DISEASE

Patients with PAD, defined as an ABI  $\leq 0.90$ , have multiple atherosclerosis risk factors and extensive atherosclerotic disease, which puts them at markedly increased risk for cardiovascular events, similar to patients with established coronary artery disease. Therefore, an abnormal ABI identifies a high-risk population that needs aggressive risk factor modification and antiplatelet therapy.

## **Modification of atherosclerotic risk factors:**

### **Smoking cessation**

- The number of pack years is associated with disease severity, an increased risk of amputation, peripheral graft occlusion and mortality. Given these associations, smoking cessation has been a cornerstone of the management of PAD as is the case for CAD.

### **Weight reduction**

- Patients who are overweight (body mass index [BMI] 25-30) or who are obese (BMI >30) should receive counseling for weight reduction.

### **Hyperlipidemia**

- Independent risk factors for PAD include elevated levels of total cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, and lipoprotein (a). Current recommendations for the management of lipid disorders in PAD are to achieve an LDL cholesterol level of <2.59 mmol/L (<100 mg/dL) and to treat the increased triglyceride and low HDL pattern.

### **Hypertension**

- Hypertension is associated with a two- to three-fold increased risk for PAD. The current recommendation is a goal of <140/90 mmHg, and <130/80 mmHg if the patient also has diabetes or renal insufficiency.

### **Diabetes**

- Diabetes increases the risk of PAD approximately three- to four-fold, and the risk of claudication twofold. Aggressive blood-glucose lowering can prevent microvascular complications (particularly retinopathy and nephropathy). The current American Diabetes Association guidelines recommend hemoglobin A1C of <7.0% as the goal for treatment of diabetes.

### **Homocysteine**

- An elevated plasma homocysteine level is an independent risk factor for PAD.

## Antiplatelet drug therapy

- Aspirin/acetylsalicylic acid (ASA) is a well-recognized antiplatelet drug for secondary prevention that has clear benefits in patients with cardiovascular diseases. The current recommendations would strongly favor the use of low-dose aspirin/ASA in patients with cardiovascular diseases.
- Clopidogrel shown to be effective in the symptomatic PAD population to reduce the risk of myocardial infarction, stroke and vascular death. The overall benefit in this particular group was a 24% relative risk reduction over the use of ASA. Clopidogrel has a safety profile similar to ASA, with only rare reports of thrombocytopenia. Recent publications in patients with acute coronary syndromes suggest that combination therapy with ASA and Clopidogrel is more effective than with ASA alone, but at a higher risk of major bleeding.

## Health Economics of Risk-factor Management

- \* Laws that reduce the amount of added salt in processed foods and that increase taxes on tobacco are more cost effective than individual prevention alone, but a combination of both is best.

All PAD patients should be considered at high risk for the following co-existing diseases:

- Coronary Artery Disease
  - \* Patients should be evaluated for evidence of CAD. Treatment decisions for coexisting CAD should be based on current practice standards, and patients who have unstable symptoms (acute coronary syndrome, decompensated heart failure) should be referred to a cardiovascular physician for appropriate diagnosis and treatment.
- Carotid Artery Disease
  - \* Patients with PAD are at an increased risk for cerebrovascular events. Evaluation of the carotid circulation should be based on a history of transient ischemic attack or stroke.
- Renal Artery Disease
  - \* Patients with PAD are at an increased risk for renovascular hypertension.

# MANAGEMENT of PAD

Management of patients with PAD will depend on the severity of the disease.

## **Intermittent Claudication**

The majority of patients with PAD have limited exercise performance and walking ability. The initial approach to the treatment of limb symptoms should focus on structured exercise and, in selected patients, pharmacotherapy to treat the exercise limitation of claudication (risk factor modification and antiplatelet therapies are indicated to decrease the risk of cardiovascular events and improve survival).

## **Exercise rehabilitation**

The exercise prescription should be based on exercise sessions that are held three times a week, beginning with 30 minutes of training but then increasing to approximately 1 hour per session. During the exercise session, treadmill exercise is performed at a speed and grade that will induce claudication within 3-5 minutes. The patient should stop walking when claudication pain is considered moderate (a less optimal training response will occur when the patient stops at the onset of claudication). The patient will then rest until claudication has abated, after which the patient should resume walking until moderate claudication discomfort recurs.

## **Pharmacotherapy for Intermittent Claudication (IC)**

Patients with IC should all receive drug and lifestyle treatment for their cardiovascular risk factors and coexisting diseases to prevent cardiovascular events associated with atherosclerosis. Pharmacotherapy for intermittent claudication (IC) can be divided into the following groups:

## 1. **Drugs with evidence of clinical utility in claudication**

- Cilostazol:
  - \* Cilostazol is a phosphodiesterase III inhibitor with vasodilator, metabolic and antiplatelet activity. Cilostazol 100 mg BID. However, it should not be given to patients with any evidence of congestive heart failure.
- Naftidrofuryl:
  - \* (Naftidrofuryl 5-hydroxytryptamine type 2 antagonist and may improve muscle metabolism, and reduce erythrocyte and platelet aggregation. Increased pain-free walking distance performance and quality of life.

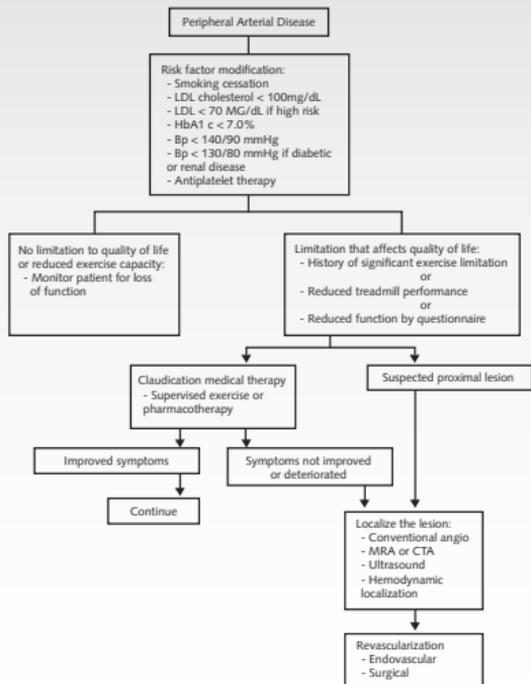
## 2. **Drugs with supporting evidence of clinical utility in claudication**

- Carnitine and Propionyl-L-Carnitine
  - \* L-carnitine and propionyl- L-carnitine interact with skeletal muscle oxidative metabolism, and these drugs are associated with improved treadmill performance. Propionyl-L-carnitine (an acyl form of carnitine) was more effective than L-carnitine in improving treadmill walking distance.
- Lipid lowering drugs
  - \* Patients with PAD have endothelial and metabolic abnormalities secondary to their atherosclerosis, which may be improved with statin therapy.

## 3. **Drugs with insufficient evidence of clinical utility in claudication**

- Pentoxifylline
- Antithrombotic agents
- Vasodilators
- Prostaglandins

# treatment strategy in the Management of PAD

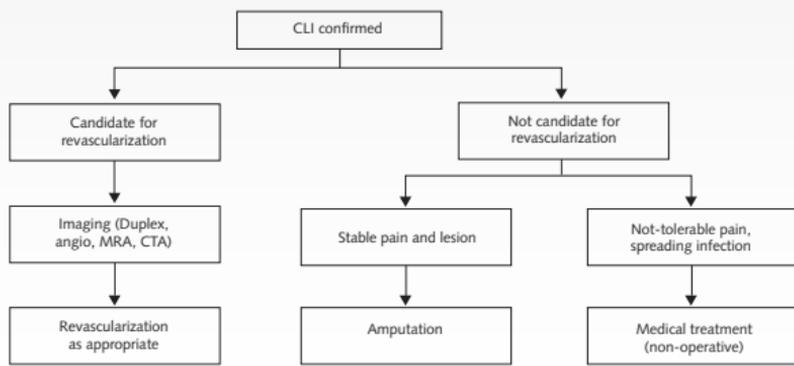


**Figure 4:** Overall treatment strategy for peripheral arterial disease. BP- blood pressure; HbA1c - hemoglobin A1c; LDL - low density lipoprotein; MRA - magnetic resonance angiography; CTA - computed tomographic angiography.

## Critical Limb Ischemia

Critical limb ischemia (CLI) is a manifestation of peripheral arterial disease (PAD) that describes patients with typical chronic ischemic rest pain (symptoms for more than 2 weeks). The primary goals of the treatment of CLI are to relieve ischemic pain, heal (neuro) ischemic ulcers, prevent limb loss, improve patient function and quality of life and prolong survival. A primary outcome would be amputation-free survival. In order to achieve these outcomes,

most patients will ultimately need a revascularization procedure requiring referral to a vascular specialist. Other components of treatment of patients with CLI are medical interventions to control pain and infection in the ischemic leg, prevention of progression of the systemic atherosclerosis, and optimization of cardiac and respiratory function. For some CLI patients with severe comorbidities or a very limited chance of successful revascularization, a primary amputation may be the most appropriate treatment. Cardiovascular risk factor control is mandatory in CLI patients as well as in all PAD patients.



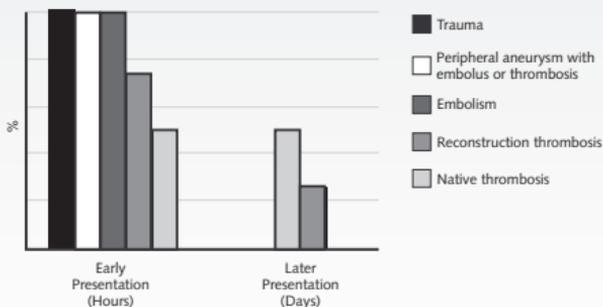
**Figure 5:** Algorithm for treatment of the patient with critical limb ischemia.

Contraindications are: patients not fit for revascularization; revascularization not technically possible; benefit cannot be expected (i.e. widespread ulceration gangrene). **CLI** - critical limb ischemia; **MRA**- magnetic resonance angiography; **CTA** - computed tomographic angiography.

## Acute Limb Ischemia

Acute limb ischemia (ALI) is any sudden decrease in limb perfusion causing a potential threat to limb viability. Presentation is normally up to 2 weeks following the acute event. Timing of presentation

is related to severity of ischemia and access to healthcare. Patients with embolism, trauma, peripheral aneurysms with emboli and reconstruction occlusions tend to present early (hours) due to lack of collaterals, extension of thrombus to arterial outflow, or a combination of both. On the other hand, later presentations -within days-tend to be restricted to those with a native thrombosis or reconstruction occlusions.



**Figure 6:** time to presentation in relation to etiology

## Clinical evaluation of Acute Limb Ischemia

- History Of Present Illness
  - \* The abruptness and time of onset of the pain, its location and intensity, as well as change in severity over time should all be explored.
  - \* The duration and intensity of the pain and presence of motor or sensory changes are very important in clinical decision-making and urgency of revascularization.
- Physical examination
 

The findings of ALI may include "5 P's":

  - \* Pain
  - \* Pulselessness
  - \* Pallor
  - \* Paresthesia
  - \* Paralysis

The main question to be answered by the history and physical examination is the severity of the ALI, which is the major consideration in early management decisions. Is the limb viable (if there is no further progression in the severity of ischemia), is its viability immediately threatened (if perfusion is not restored quickly), or are there already irreversible changes that preclude foot salvage? The three findings that help separate 'threatened' from 'viable' extremities are:

- Presence of rest pain,
- Sensory loss, or
- Muscle weakness

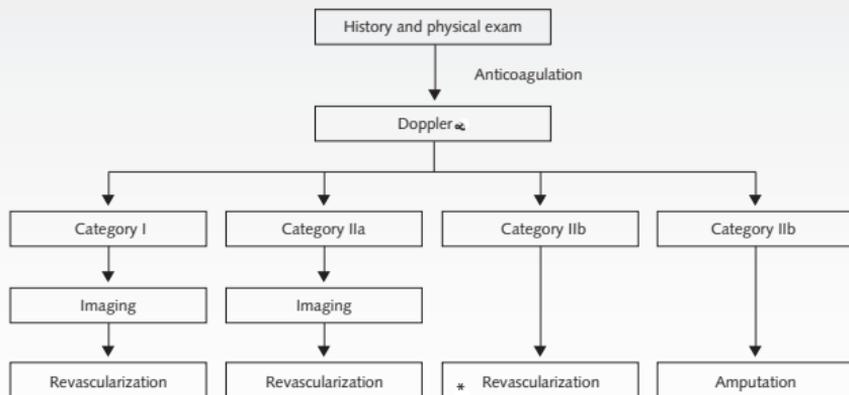
Due to inaccuracy of pulse palpation and the physical examination, all patients with suspected ALI should have **Doppler assessment of peripheral pulses** immediately at presentation to determine if a flow signal is present. Cases of suspected ALI should be evaluated immediately by a vascular specialist who should direct immediate decision making and perform revascularization because irreversible nerve and muscle damage may occur within hours.

## Separation of threatened from viable extremities

Category	Description/ prognosis	Findings		Doppler signal's	
		Sensory loss	Muscle weakness	Arterial	Venous
I. Viable	Not immediately threatened	None	None	Audible	Audible
II. Threatened					
a. Marginal	Salvageable if promptly treated	Minimal (toes) or none	None	(Often) inaudible	Audible
b. Immediate	Salvageable with immediate revascularization	More than toes, associated with rest pain	Mild, moderate  Profound,	(Usually) inaudible	Audible
III. Irreversible	Major tissue loss or permanent nerve damage inevitable	anesthetic	paralysis (rigor)	Inaudible	Inaudible

## Algorithm Management of Acute Limb Ischemia

The initial goal of treatment for ALI is to prevent thrombus propagation and worsening ischemia. Therefore, immediate anticoagulation with heparin is indicated. The standard therapy (except in cases of heparin antibodies) is unfractionated heparin intravenously.



**Figure 7:** Category I - Viable Category

IIa - Marginally Threatened Category

IIb - Immediately Threatened; Confirming either absent or severely diminished ankle pressure/signals;

\*In some centers imaging would be performed.

Catheter-Directed Thrombolysis (CDT) has become a commonly employed technique in the treatment of ALI. The data from the randomized, prospective studies in ALI, suggest that CDT may offer advantages when compared with surgical revascularization. These advantages include reduced risk of endothelial trauma and clot lysis in branch vessels too small for embolectomy balloons. In addition, it appears that reperfusion with CDT is achieved at a lower pressure and may reduce the risk of reperfusion injury compared to open surgery.

Thrombolytic therapy is, therefore, the initial treatment of choice in patients in whom the degree of severity allows time (i.e. severity levels I and IIa). More recent advances in endovascular devices and techniques, however, allow for more rapid clot removal and may permit treatment of patients with more advanced degree of ischemia. Thus, if the limb is not immediately or irreversibly threatened, CDT offers a lower-risk opportunity for arterial revascularization. Using this approach, the underlying lesions can be further defined by angiography, and the appropriate percutaneous or surgical revascularization procedure can be performed. Systemic thrombolysis has no role in the treatment of patients with ALI. Contraindication to pharmacologic thrombolysis must be taken in consideration.

## **Contraindications to thrombolysis**

### **Absolute contraindications**

1. Established cerebrovascular event (excluding TIA within previous 2 months)
2. Active bleeding diathesis
3. Recent gastrointestinal bleeding (within previous 10 days)
4. Neurosurgery (intracranial, spinal) within previous 3 months
5. Intracranial trauma within previous 3 months

## Relative contraindications

1. Cardiopulmonary resuscitation within previous 10 days
2. Major nonvascular surgery or trauma within previous 10 days
3. Uncontrolled hypertension (systolic >180 mmHg or diastolic >110 mmHg)
4. Puncture of noncompressible vessel
5. Intracranial tumor
6. Recent eye surgery

## Minor contraindications

1. Hepatic failure, particularly those with coagulopathy
2. Bacterial endocarditis
3. Pregnancy
4. Active diabetic proliferative retinopathy

Percutaneous aspiration thrombectomy (PAT) and percutaneous mechanical thrombectomy (PMT) provide alternative non-surgical modalities for the treatment of ALI without the use of pharmacologic thrombolytic agents. Combination of these techniques with pharmacologic thrombolysis may substantially speed up clot lysis, which is important in more advanced ALI where time to revascularization is critical.

Immediate surgical revascularization is indicated for the profoundly ischemic limb (class IIb). It may also be considered in those with profound sensory and motor deficits of very short duration, as revascularization completed within a few hours of onset of severe symptoms may produce remarkable recovery. Beyond this short window, major neuromuscular damage is inevitable. It must be recognized that the time from the decision to operate until reperfusion may be substantially longer than anticipated because of factors outside of the surgeons' control (e.g. operating theater availability, anesthesia preparation, and technical details of the operation). Initial therapy with catheter-based thrombolysis should be considered in cases of acute thrombosis due to

vulnerable atherosclerotic lesions or late bypass graft failures. In this manner, the underlying occlusive disease is revealed and appropriate adjunctive management may be chosen. In cases of trauma, for many reasons, surgery will be the treatment of choice in the majority of cases. Some form of intraoperative assessment of the adequacy of clot removal is required. The most common of these is 'completion' angiography to identify any residual occlusion or critical arterial lesions requiring further treatment.

## **Revascularization**

The determination of the best method of revascularization for treatment of symptomatic PAD is based upon the balance between risk of a specific intervention and the degree and durability of the improvement that can be expected from this intervention. Adequate inflow and appropriate outflow are required to keep the revascularized segment functioning. The location and morphology of the disease must be characterized prior to carrying out any revascularization to determine the most appropriate intervention.

Outcomes of revascularization procedures depend on anatomic as well as clinical factors. Anatomic factors that affect the patency include severity of disease in run off arteries, length of the stenosis/occlusion and the number of lesions treated. Clinical variables affecting the outcome also include diabetes, renal failure, smoking and the severity of ischemia.

Revascularization options includes endovascular and surgical. The endovascular techniques include balloon angioplasty, stents and stent-grafts, plaque debulking procedures, thrombolysis and percutaneous thrombectomy. On the other hand, the surgical options include bypass, endarterectomy or an intra-operative hybrid procedure. The conduit used either autogenous or synthetic.

TASC classification schemes can be used as a guide when considering either percutaneous or surgical revascularization in patients with PAD due to aortoiliac or femoral popliteal lesions as outlined below.

### **Treatment of aorto-iliac lesions:**

- TASC A and D lesions: Endovascular therapy is the treatment of choice for type A lesions and surgery is the treatment of choice for type D lesions.
- TASC B and C lesions: Endovascular treatment is the preferred treatment for type B lesions and surgery is the preferred treatment for good-risk patients with type C lesions. The patient's co-morbidities, fully informed patient preference and the local operator's long-term success rates must be considered when making treatment recommendations for type B and type C lesions.

### **Treatment of femoral popliteal lesions:**

- TASC A and D lesions: Endovascular therapy is the treatment of choice for type A lesions and surgery is the treatment of choice for type D lesions.
- TASC B and C lesions: Endovascular treatment is the preferred treatment for type B lesions and surgery is the preferred treatment for good-risk patients with type C lesions. The patient's co-morbidities, fully informed patient preference and the local operator's long-term success rates must be considered when making treatment recommendations for type B and type C lesions.

Antiplatelet therapy should be started preoperatively and continued as adjuvant pharmacotherapy after an endovascular or surgical procedure. Unless subsequently contraindicated, this should be continued indefinitely.

**Patients undergoing bypass graft placement in the lower extremity for the treatment of claudication or limb-threatening ischemia should be entered into a clinical surveillance program.**

**This program should consist of:**

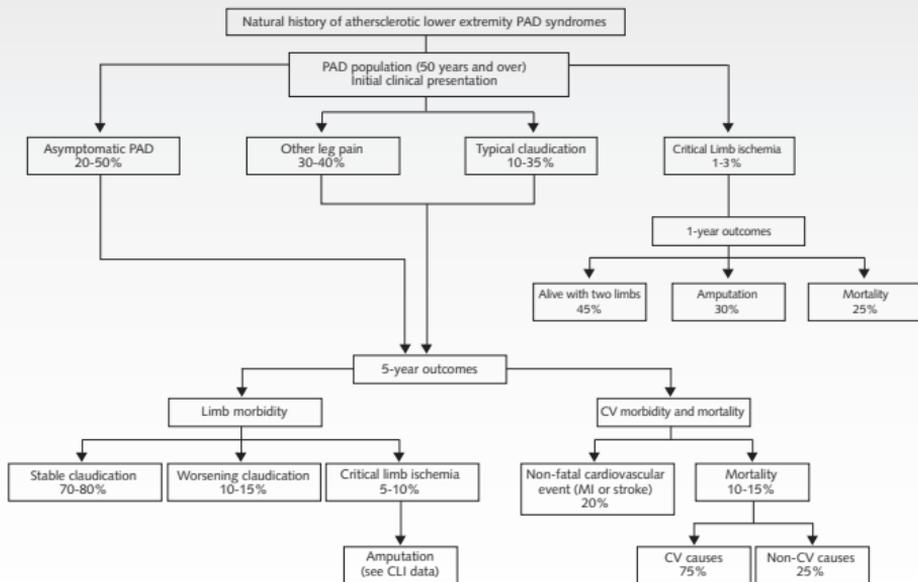
- Interval history (new symptoms)
- Vascular examination of the leg with palpation of proximal, graft and outflow vessel pulses
- Periodic measurement of resting and, if possible, post-exercise ankle-brachial indices

**Clinical surveillance programs should be performed in the immediate postoperative period and at regular intervals (usually every 6 months) for at least 2 years.**

## **Outcome of the patient with PAD**

Evidence suggests that the progression of the underlying PAD is identical whether or not the subject has symptoms in the leg. A changing ABI is possibly the best individual predictor of deterioration of PAD. The increased risk of cardiovascular events in patients with PAD is related to the severity of the disease in the legs as defined by an ABI measurement. The annual overall major cardiovascular event rate (myocardial infarction, ischemic stroke and vascular death) is approximately 5-7%. Excluding those with critical limb ischemia (CLI), patients with PAD have a 2% to 3% annual incidence of non-fatal myocardial infarction and their risk of angina is about two- to three- times higher than that of an age-matched population. The 5-, 10- and 15-year morbidity and mortality rates from all causes are approximately 30%, 50% and 70%, respectively.

# NATURAL HISTORY of ATHEROSCLEROTIC LOWER EXTREMITY PAD syndrome



**Figure 8:** fate of the claudicant over 5 years (adapted from ACC/AHA). PAD- peripheral arterial disease; CLI- critical limb ischemia; CV- cardiovascular; MI- myocardial infarction.

## Acknowledgements

The development of this document was supported by Sanofi-aventis Gulf Countries. The sponsors did not participate in any of the discussions or provide recommendations as to the preparation of these guidelines. The PAD Advisory board, GHA – PAD GCC Guideline Committee acknowledges the input of Professor Najeeb AlKhaja, Dr Abdulaziz Al-Muzaini and Dr Amit Kumar. We also greatly appreciate the administrative and logistic assistance provided by Dr. Hisham Mahmoud and his team.

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