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Peripheral Emergencies

Reza Omidi Varmezani
Hospital Buelach
Switzerland
Email: cisgnl [AT] yahoo.com

ABSTRACT---- ***Early and adequate diagnosis is important for improving the patient`s quality of life and for reducing the risk of secondary vascular attacks. Patients with Peripheral vascular injuries present daily in emergency departments. A basic understanding of both blunt and penetrating injuries to the extremities and the resultant vascular abnormalities that occur with these injuries helps minimize mortality and morbidity. Management of peripheral vascular trauma utilizing endovascular techniques has increased in frequency as trauma surgeons have been more familiar with capabilities and more interventionalists experienced in these techniques become available. Extremity vascular and iliac artery trauma are common in most urban trauma centers with significant morbidity and mortality. Iliac artery injury has a reported 40% mortality. However, for the purposes of endovascular therapy, separation of the peripheral vascular bed into vascular segments and territories is useful, mainly because of differences in vessel structure and morphology that prescribe different interventional strategies. In specific vascular beds other etiologies must be considered in differential diagnostics. The response to arterial wall injury induces an inflammatory reaction, which over time forms the histopathological basis of PAD, identical to that seen in the coronary vasculature and brain vascular bed by development of atherosclerosis and subsequent plaque instability. The histopathological basis of disease is identical to that seen in the coronary vasculature and other vascular beds.***

Although diagnostic and therapeutic decisions in patients with vascular disease are guided primarily by the history and physical examination, the use of non-invasive investigations has increased significantly in recent years, mainly as a result of technological advances in ultrasonography. Spiral computed tomography and Magnetic resonance angiography are new, minimally invasive techniques for vascular imaging. CTA and MRA replaced already the invasive angiography. Magnetic resonance angiography has the advantage of imaging a moving column of blood and does not require ionising radiation or iodinated contrast, but the technique has obvious drawbacks in terms of cost efficiency and accessibility to scanners.

Endovascular treatment with balloon angioplasty is well accepted for short segmental disease of the femoropopliteal artery. The immediate technical success of revascularization of the femoropopliteal segment by balloon angioplasty is reportedby almost all working groups to be very high.

Communication inside the highly specialized vascular team is necessary to make a therapy plan with low risk for the patient.

Exact knowledge of peripheral vascular anatomy is required for optimum image acquisition and interpretation. The development of duplex mapping, computer tomography (CTA), and magnetic resonance arteriography (MRA) is likely to obviate the need for much, of the strategic arteriography performed. DSA is reserved for interventional procedures.

Keywords--- Interventional radiology, Peripheral Artery Disease, Peripheral Intervention, Endovascular Techniques

1. INTRODUCTION

Peripheral arterial disease is one of the most prevalent conditions, and it frequently associated with an increased risk of vascular disease in other parts of the body and substantial functional limitation. The initial disease process results in peripheral arterial disfunction causes turbulent flow in the arteries supplying the muscles of the lower extremities. Impaired endothelial function and limited blood flow results in an oxygen supply-demand mismatch.

Early and adequate diagnosis is important for improving the patient`s quality of life and for reducing the risk of secondary vascular attacks. The presence of critical ischemia indicates the need for prompt revascularization because of high risk of limb amputation.

In the healthy condition is ABI-index more than 0.90, whereas in PAD is less than 0.90 at rest with a further decrease after exercise.

Embryology

During the first 20 days of development, the human embryo has no cardiovascular structure. Over the next month, the heart and great vessels complete their development and look very much like they will at full gestation.

The digits arising from limb buds during this time (8 weeks). The limb buds are supplies of the intersegment arteries, which arise from the aorta.

The vascular patterns change as the limbs develop, chiefly by angiogenesis.

In the thigh the primary axial artery is represented by the deep artery of the thigh (profund femoris artery).

In the leg, the anterior and posterior tibial arteries represent the primeral axial artery.

2. ARTERIES OF THE LOWER EXTREMITIES

The common iliac arteries form the terminal bifurcation of the abdominal aorta approximately at the level of the fourth vertebral body (Fig. 2). The internal iliac artery arises from the medial aspect of the bifurcation of the common iliac artery. (Heuser)

The common femoral artery is the continuation of the external iliac artery after it passes through the inguinal canal. The common femoral artery gives rise to the superficial circumflex iliac artery and the pudendal branches. The common femoral artery then bifurcates into the superficial femoral artery and the arteria profunda femoris (profunda). The femoral profundaartery comes off posterolaterally, and thus the femoral bifurcation is best seen angiographically with a 30° RAO or LAO view. The superficial femoral artery courses along the medial aspect of the thigh and continues on as the popliteal artery when it exits the adductor canal via the adductor hiatus. Prior to passing through the adductor canal, it gives rise to the superior genicular artery. It provides the superior, middle, and inferior genicular arteries, which have anastomoses with genicular branches from the superficial femoral and femoral profunda arteries. The popliteal artery continues below the knee until it bifurcates into the anterior tibial (lateral take off) and tibioperoneal trunk, which subsequently bifurcates into the peroneal artery and the posterior tibial artery, which is the medial-most artery. The anterior tibial artery passes between the tibia and fibula to run anterior to the interosseous membrane and eventually forms the arteria dorsalis pedis. (Heuser)

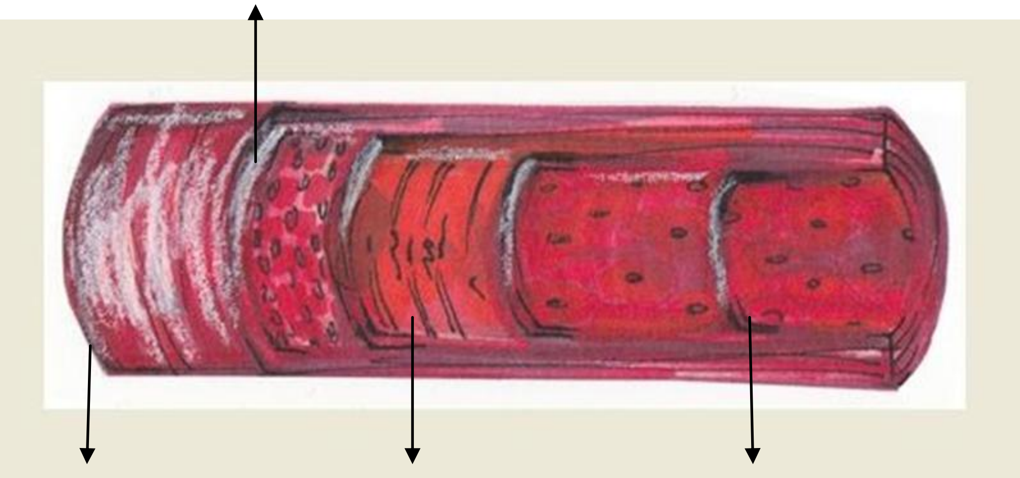
Fig. 1 Angiogram of the lower extremities to the level of the knee. (1) Common iliac; (2) internal iliac (hypogastric); (3) external iliac; (4 common femoral; (5) profunda femoris;(6) superficial femoral artery (SFA). Note the near total occlusion of the left SFA (7).

Fig. 2 Angiogram of the lower extremities below the level of the knee. Ant. tib., anterior tibial; Post. tib., posterior tibial. Note the occlusion of the right popliteal, with collaterals filling the posterior tibial.

Structure of arteries

The big arteries have three layers, innermost provide a selectively permeable barrier. The middle layers strengthen the vessel and provide vasomotion (vasodilatation and vasoconstriction). The outermost layer provie passage for vasa vasorum (vessels of the vessels), protection and anchoring.

Because of this construction have the arteries unique pathology (for example aging process or dissection). Almost all arterial diseases are associated with lumen changes and therefore hemodynamic changes.



Peripheral arterial disease classification

- Dissections / (pseudo) Aneurysm
- Occlusive disease (Arteriosclerosis)
- Congenital abnormalities
- Trauma
- Compression Syndromes
- Tumors
  - Primary
  - Secondary

3. ANEURYSMA

Femoral Pseudoaneurysma

Although true aneurysms involves all three layers of the wall of an artery (intima, media and adventitia), false aneurysms or pseudoaneurysms are regarded as either a blood leaking collection (after a rupture) out of an artery or vain, but limited adjacent to the vessel by the enclosing tissue without the 3 layers of vessel wall.

A peseudoaneurysm is as a matter of fact a hematoma outside the vessel wall. It must continue to interchange with the vessel lumen to be considered a pseudoaneurysm.

Generally is the pseudoaneurysm consequence of an arterial injury, for instance arterial catheterization or penetration trauma.

Femoral pseudoaneurysm (0.26%) is the second most common complication of vascular interventional procedures after bleeding. The incidence is detected as a major vascular complication rate, within 0.02% and 2%, accord-ing to different literature reports. Pseudoaneurysm formation is less associated with diagnostic procedures compared to interventional procedures. Color Duplex ultrasonography examination can be a sufficient and effective tool to confirm the diagnosis of pseudoaneurysm and may be a part of treatment with compression technique. (Demirbas)

Popliteal artery aneurysm

Aneurysms form for a variety of different internal and external factors like atherosclerosis, infection, etc.

Popliteal artery aneurysms are rarely symptomatic and usually discovered on routine physical examination. They tend to occur in elderly and form the most common true peripheral aneurysm, more frequently than femoral artery aneurysms, but less frequently than abdominal aortic aneurysm. The prevalence of popliteal aneurysm in the general population is difficult to determine, but appears to be increasing possibly due to more common use of imaging modalities and an aging population (Björck & Ravn).

A screening study of 1074 men identified popliteal artery aneurysm in 1 percent (Trickett). In another screening study of men between the ages of 65 and 74, abdominal aortic aneurysms were identified in 4.9 percent of patients (Diwan, Sarkar, & Stanley). Of these patients, 6.8 percent had femoral artery aneurysms and 9.6 percent had popliteal artery aneurysms.

US are often the initial imaging modality of choice, however CT is useful for assessment of vessels distal to the aneurysm.

Arterio Venous Fistula

An arterio venous fistula is an abnormal connection between an artery and a vein, bypassing some capillaries. When this happens tissues below the bypassed cappilaries receive less blood supply.

An AVF could raise secondary to trauma, postinterventional or congenital (for example Rendu-Osler-Weber-syndrome).

These lesions are extremely difficult to diagnose or treat because of varying of clinical manifestation and very high recurrence rate. The main locations are head-neck (40% of cases) and extremities (40% of cases).

The malformation caused by abnormal differentiation during embryogenesis, may not be evident until additional growth or vascular engorgement as a response to thrombosis, trauma or infection.

The vascular malformation could consist one or several feeding arteries and drainage veins plus nidus. Depend of type of malformation the therapy consist of sclerotherapy with or without flow control procedure by using balloon catheter or coils to occlude the drainage vein.

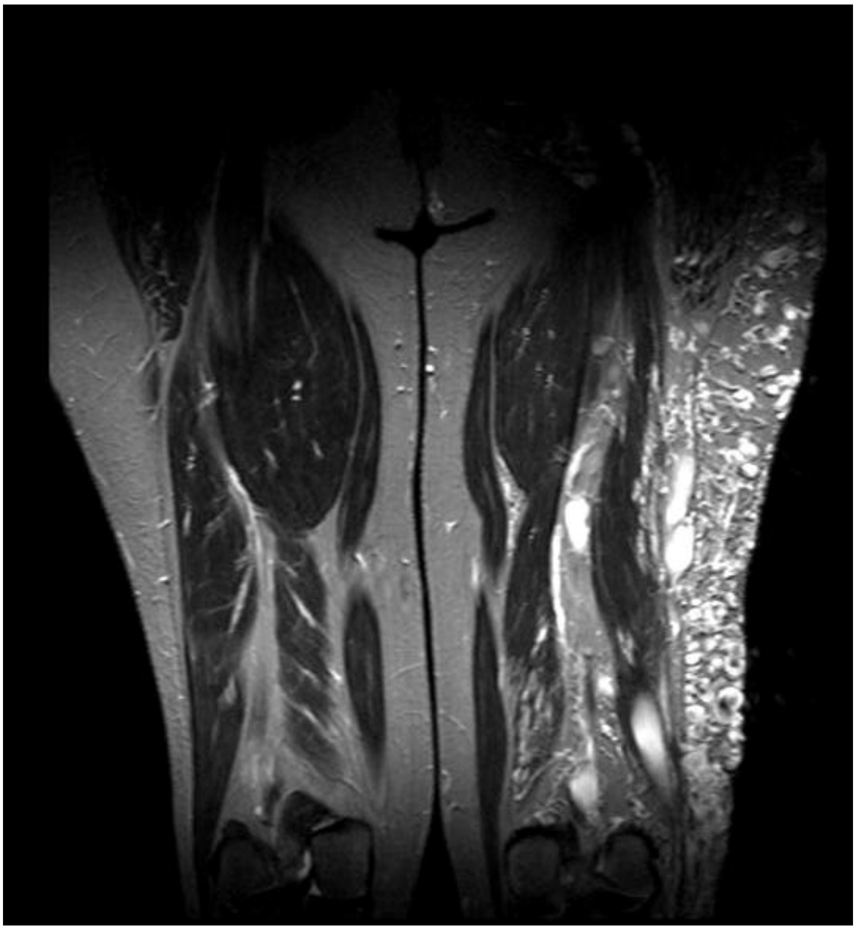


Fig. 3 An example of high-flow vascular malformation. Coronar MRI scan with contrast material enhancement shows dilated vessels within the muscle.

Peripheral vascular trauma

Patients with Peripheral vascular injuries present daily in emergency departments. A basic understanding of both blunt and penetrating injuries to the extremities and the resultant vascular abnormalities that occur with these injuries helps minimize mortality and morbidity.

- Contusion
- Partial Transection
- Transection
- Arterio venous fistula

Fig. 4 25 years old male after car accident, emergency operation with external fixation. Conventional DSA angiography shows dissection group. Collateralisation the foot arteries througout a. communicans and recurrens with acceptable perfusion of the foot. No extraluminal contrast material.

Management of peripheral vascular trauma utilizing endovascular techniques has increased in frequency as trauma surgeons have been more familiar with capabilities and more interventionalists experienced in these techniques become available.

In a review of the National Trauma Data Bank, Reuben et al found an increase from 2.1% in 1994 to 8.1% in 2003 in the use of EVIs for vascular trauma. Fifty-five percent of vascular injuries are from blunt mechanisms, and 45% are secondary to penetrating trauma. The blood vessels that are most frequently injured in blunt trauma are the iliac, internal carotid, and brachial arteries and the thoracic aorta. The most frequently injured vessels in penetrating trauma are the brachial artery and the superficial femoral artery (SFA).(Chatt)

Extremity vascular and iliac artery trauma are common in most urban trauma centers with significant morbidity and mortality. Iliac artery injury has a reported 40% mortality. Penetrating and blunt injuries to the popliteal artery have mortalities of 10.5 and 27.5%, respectively, and injuries to the tibial arteries have an amputation rate of 38% (Chatt).

Both multislice computerized angiotomography and magnetic resonance angiography are being increasingly used for the diagnosis and surgical planning. Magnetic resonance angiography enables 3-dimensional images to be obtained safely of the whole abdomen, the pelvis, and the lower limbs at one single study.

4. OCCLUSIVE ARTERIAL DISEASE

Definitions and classification systems

Intermittent claudication is a clinical diagnosis given for muscle pain caused by too little blood flow during exercise.

Symptoms of PAD as known are pain or color changes in the extremities, due to metabolic abnormalities because of reduced blood flow and O2 delivery.

The term peripheral arterial disease (PAD), also known as peripheral artery occlusive disease or peripheral vascular disease implies to the hemodynamic stenosis or obstruction of arteries

In the context of this paper peripheral arterial disease (PAD) refers to the diseases of the infrainguinal arteries**,** includes a subset of femoropopliteal and infrapopliteal segment.

Vascular disease of the upper extremity and coronary arteries have not been implied primarily

Vessels continuity is maintained and blood flow is preserved apparently from proximal to distal. That`s why disease of the proximal arteries always have a crucial impact on all downstream arteries, so- called run-in effect. Conversely, run-off effect refers to affection of the proximal vessels (upstream circulation) by disease of the downstream vessels.

Consequently, due to the pathophysiological point of view, there is a composed interconnected vessel network distal to the abdominal aorta that construct a hydrodynamic functional unit.

However, for the purposes of endovascular therapy, separation of the peripheral vascular bed into vascular segments and territories is useful, mainly because of differences in vessel structure and morphology that prescribe different interventional strategies. (Lanzer)

Classification of PAD based on symptom severity

Intermittent claudication is a symptom produced consistently by physical exercise such as walking and is relieved by a period of rest. The severity of the symptoms can be determined in the clinical setting utilizing different classifications.

Standard classifications such as the Fontaine or Rutherford scales are commonly used in research settings and do not correlate well with the degree of disability experienced by patients.

The classification by Fontaine has two stages of claudication whereas the Rutherford classification is more differentiated.

Both categorise PAD in terms of symptoms (asymptomatic, intermittent claudication, ischemic rest pain or ulceration and/or gangrene) and severity (mild, moderate or severe).

The Fontaine classification classifies according to the spectrum and severity of the presented symptoms, the distance that a patient can walk before pain occurs (pain free walking distance) dividing into two groups based upon a PFWD of greater than or less than 200 metres. The Rutherford classification uses three groups based upon a combination of the results of a treadmill exercise test and ABI values. (Layden, Bermingham & Higgins)

Table 1 – The Fontaine classification

Grade I	Asymptomatic
Grade IIa	Intermittent claudication after more than 200 meters of pain free walking.
Grade IIb	Intermittent claudication intermittent claudication after less than 200 meters of walking
Grade III	Rest pain, paresthesia
Grade IV	Established gangrene. Trophic lesions
Grade III and/or IV	Critical ischemia. Threat o floss of limb

Etiology of PAD

Peripheral artery disease is often caused in the majority of patients by atherosclerosis and diabetes mellitus**.** Less commonly, the cause of peripheral artery disease may be blood vessel inflammation, for example vasculitides and obliterating thrombangitis of Winiwarter and Buerger, injury to the limbs, unusual anatomy of ligaments or muscles, or radiation exposure, are rare by comparison. In atherosclerosis, fatty deposits (plaques) build up in the artery walls and reduce blood flow.

In specific vascular beds other etiologies must be considered in differential diagnostics. For example, in the popliteal artery, an entrapment syndrome may occur due to outside compression of the artery by the gastrocnemius, popliteus, or soleus muscles, as may aneurysms and cystic adventitial disease (compression of the artery by mucoid adventitia-derived cysts). (Lanzer)

5. EPIDEMIOLOGIE AND PATHOPHYSIOLOGY: ATHEROSCLEROSIS AND OTHER CAUSES OF PERIPHERAL ARTERIAL DISEASE

Peripheral artery disease (PAD) affects 15%-20% of persons older than 70 years of age, though its prevalence is probably even greater if we include asymptomatic persons. (Serrano & Conejero)

The Rotterdam study, a population-based analysis of over 7000 patients, showed a frequency of claudication ranging from 1% in those 55 to 60 years of age to.5% in those over age 80. (Garcia)

PAD is associated with a great degree of impairment in vascular function and has a risk factor profile similar to CAD: age, gender, diabetes, to-bacco abuse, hypertension, and hyperlipidaemia.

Presence of PAD, by any of various criteria, is associated with increased mortality rate because of greater risk of CAD.

As coronary artery disease, the most common cause of symptomatic obstruction in

the peripheral arterial tree is atherosclerosis, a primarily systemic inflammatory process. The response to arterial wall injury induces an inflammatory reaction, which over time forms the histopathological basis of PAD, identical to that seen in the coronary vasculature and brain vascular bed by development of atherosclerosis and subsequent plaque instability.

The histopathological basis of disease is identical to that seen in the coronary vasculature and other vascular beds.

Proper limit of alcohol intake and regular physical training have both determined as protective.

Vasculitides may induce PAD in a small group of patients, because they are not known to affect the peripheral vasculature.

The other rare though possible causes of PAD are thromboangiitis obliterans (Burger`s disease), Hypercoagulable states such as protein C or S deficiency or antithrombin III deficiency, and the vasospastic syndromes.

Major modifiable risk factors for PAD include diabetes and cigarette smoking. Critical prognosis of PAD, primarily as a harbinger of CVD morbidity and mortality has been well documented and widely recognized. Table 2 compares the annual incidence, prevalence and mortalityof patients with PAD, ACS, TIA and stroke.

Table 2. the annual incidence, prevalence and mortalityof patients with PAD, ACS, TIA and stroke Criqui M,et al. Circulation 1985; 71:510

	Annual Incidence	prevalence	Mortality
Stroke	0.73	4.6	28
TIA	0.50	4.9	6.3
ACS	2.3	12.6	45
PAD		8-12	4-25

The natural history of PAD is slow progression of symptoms over time**,** at the same time characterized by an increased risk of coronary and cardiovascular ischemic events.

There is considerable variation within this overall pattern. In most patients, the disease progression is relatively benign. A great majority of patients will remain asymptomatic or with fairly stable symptoms; some may even show improvement. A large population study found that 5 years after diagnosis of PAD, 63% of patients showed angiographic progression, but 66% still had no limiting intermittent claudication. (Garcia)

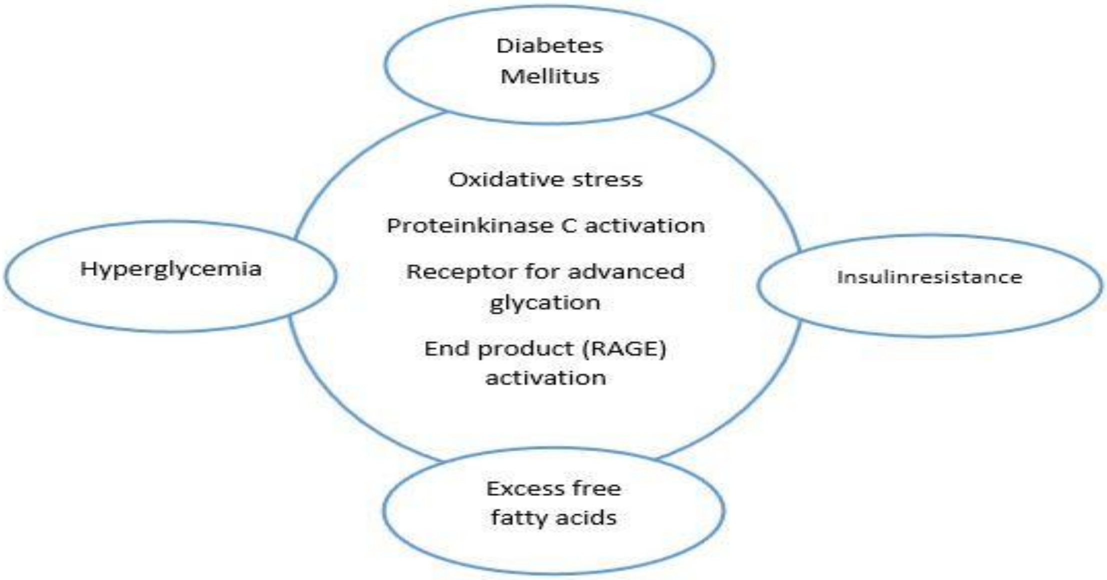
How about asymptomatic PAD? Is it really matter? Coexistence of peripheral arterial disease and coronary artery disease is common. PAD worsens the prognosis of patient with CAD. Dus patients with PAD should be treated for secondary prevention, regardless of diagnosis of CAD.

Comparison of patients with PAD versus age-matched controls shows an incidence of cardiovascular death of 0.5% in controls and 2.5% in the patients with PAD. Additionally, in persons with known coronary artery disease, the presence of PAD raises the risk of death by 25% in comparison with controls. It is thus important to examine for PAD, even in asymptomatic patients, in order to control the risk factors as soon as possible and reduce mortality4. (Serrano & Conejero)

Whereas the clinical diagnosis of PAD is dependent on the vascular history, the epidemiologic studies have implied the multisystemic involvement of vascular disease and it is usual to find coronary or cerebrovascular disease in patients with vascular disease.

Clinical experiments have shown that up to 50% of patients with PAD also have symptoms of cerebrovascular or heart disease**.**

In the PARTNERS study, of all the patients who were screened for vascular disease, only 13% had isolated PAD with no other manifestation of cardiovascular disease. Thirty-two percent of the patients also had either coronary disease or cerebrovascular disease, and 24% had involvement in all 3 territories. The main cause of late death in patients with PAD is ischemic heart disease (up to 50% of deaths in patients with PAD). Inversely, the prevalence of PAD in patients diagnosed with coronary disease reaches 30%4. The mortality in this group of patients is 2.5 times greater than that of the group with no clinical symptoms of PAD. (Serrano & Conejero)



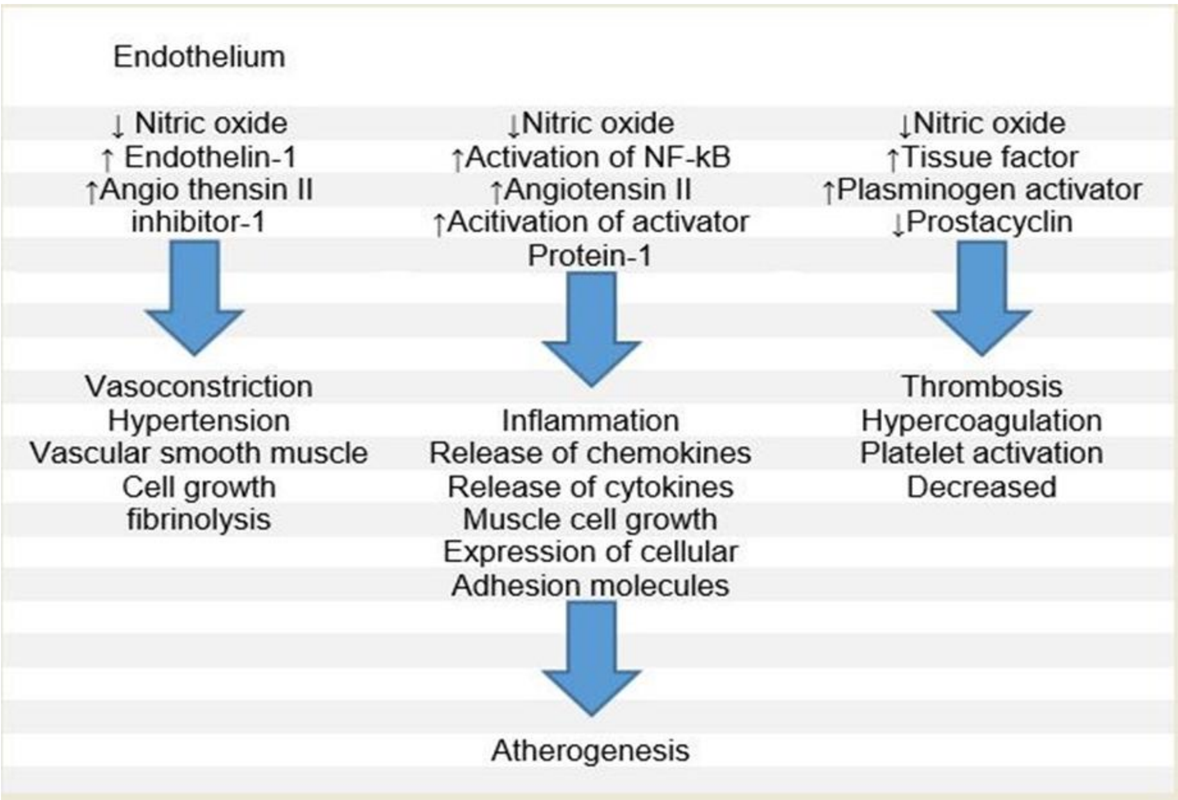


Fig. 5 Atherogenesis in diabetes. This model of endothelial dysfunction illustrates the central role of the inflammatory cascade in atherogenesis. Inflammation is now considered to be a major factor in all stages of atherogenesis in nondiabetic as well as diabetic patients. Adapted with from Beckman et al.23

6. DIAGNOSTIC APPROACH

Non-Invasive functional assessment

Although diagnostic and therapeutic decisions in patients with vascular disease are guided primarily by the history and physical examination, the use of non-invasive investigations has increased significantly in recent years, mainly as a result of technological advances in ultrasonography.

Without question, the ankle-brachial index (ABI) result can help diagnose peripheral arterial disease. ABI is easy to perform and most common vascular test to detect impaired vascular insufficiency of the lower extremities.

In its most simple form, the test compares blood pressure in the ankle to blood pressure in the arm. A Doppler ultrasound device and standard blood pressure cuff are used to register systolic pressures of both brachial arteries in the supine position at rest**.** Next, blood pressures are again obtained with the pressure cuff at the ankle, and the Doppler transducer is used to determine systolic pressures of the dorsalis pedis and posterior tibial arteries. As the blood pressure cuff deflates, the blood pressure in the arteries is recorded. A computer converts sound waves into a picture of blood flow in the arteries and veins.

The ratio of ankle pressure to brachial pressure (ABI) is then derived. A ratio of ≥0.9 is found in patients without claudication**.** The patient is diagnosed with PAD when the ABI is ≤ 0.90 and at least 0.5. Patients with rest pain usually have ABIs less than 0.5 and an absolute pressure less than 50 mmHg. (Heuser)

In asymptomatic persons, an ABI <0.9 has a sensitivity >95% and a specificity approaching 100% as compared with arteriography4. **(**Serrano & Conejero**)**

Duplex ultrasonography has a sensitivity of 80% and a specificity of 90-100% for detecting femoral and popliteal disease.

ABI and Doppler is non-invasive and accurate diagnostic tool to detect and evaluate the arterial flow dynamics in the affected area. But is that enough?

Non-invasive functional assessment says there is something wrong but no comprehensive qualitively significant and anatomical information. Without utilizing supplemented radiological depiction there is no ability to plan an intervention.

Spiral computed tomography and Magnetic resonance angiography are new, minimally invasive techniques for vascular imaging. CTA and MRA replaced already the invasive angiography. Multislice computerized tomography can also provide excellent 3-dimensional images and give information about the characteristics of the plaque, and all during a very quick study. A helical scan can cover the entire region of interest in one 10-40 second exposure.

Magnetic resonance angiography has the advantage of imaging a moving column of blood and does not require ionising radiation or iodinated contrast, but the technique has obvious drawbacks in terms of cost efficiency and accessibility to scanners.

DSA is reserved for interventional procedures.

PAD Therapy

Lower extremity and specially femoropopliteal segment are the most common anatomic locations of atherosclerotic lesions.

Analysis of the distribution of peripheral arterial obstructive disease shows that more than 50% of all lesions are localized in the femoropopliteal region. Corresponding to the length of this vessel, diffusely stenosed segments and long occlusions dominate over focal stenoses. The natural history of isolated SFA disease predicts a low amputation risk (0–1%) without surgical revascularization. This benign natural history often drives physicians to avoid surgical or interventional treatment. Endovascular treatment with balloon angioplasty is well accepted for short segmental disease of the femoropopliteal artery. The immediate technical success of revascularization of the femoropopliteal segment by balloon angioplasty is reportedby almost all working groups to be very high, reaching from 80% to more than 95%. However, long-term results vary widely from 5-year patency rates of 68% in patients with stenosis and claudication to only 12% in patients with occlusion and critical ischemia. (Heuser)

Treatment of patients affected by PAD consists of a non-pharmacological (life modification or life style changes) and pharmacological approach. Of course, modification of risk factors is the first measure to implement.

For pharmacological treatment of PAD, do not forget, you are treating a systematic disease, therefore such patients need to be identified and treated even more aggressively than patients with CAD only.

Treatment strategies of patients with peripheral artery disease have 2 major goals. One, to manage symptoms, optimizes the functional situation of the leg (symptom relief), and 2, to prevent events secondary to the multifocal distribution of the disease.

The drugs used in PAD can be directed at specific treatment of the claudication, in an attempt to resume physical activities**,** or at the secondary prevention of cardiovascular and neurovascular events, thus achieving a better vital prognosis for these patients.

Table3. Effect of medical Therapies in Subjects with peripheral artery disease(Serrano & Conejero)

	Reduction of events/year	*Relative risk reduction*	*Number needed to treat*
Aspirin vs. placebo	**4.6%**	**15**	**140**
Clopidogrel vs. aspirin	**4.8%**	**24**	**94**
Ramipril vs. placebo	**4.4%**	**26**	**88**
Simvastatin vs. placebo	**6.1%**	**21**	**86**

Endovascular techniques

Principles of Intervention

The very most important duty of an interventional radiologist is making a proper imaging to make a proper treatment plan. Do not forget interventional radiologist is a part of specialized team with surgeons, angiologist and internists. Communication inside the highly specialized vascular team is necessary to make a therapy plan with low risk for the patient.

Exact knowledge of peripheral vascular anatomy is required for optimum image acquisition and interpretation.

The development of duplex mapping, computer tomography (CTA), and magnetic resonance arteriography (MRA) is likely to obviate the need for much, of the strategic arteriography performed. DSA is reserved for interventional procedures.

Technological advances of non-invasive multidetector computer tomographic angiography (CTA) and magnetic resonance angiography (MRA) with three-dimensional imaging and their increasing ability to localize and to determine anomalies have transformed the indication and utilization for diagnostic digital subtraction angiography (DSA).

Both magnetic resonance angiography (MRA) and computed tomography scan (CTA) are used to detect, evaluate and follow up peripheral vascular lesions. Utilizing invasive digital substraction angiography (DSA) have now become reserved to specific settings, frequently exclusively in combination with interventional procedure standby or depending on actual validity of non-invasive studies in individual patients.

To allow definitive decisions on the need for and technical feasibility of peripheral arterial revascularization, diagnostic arteriography should provide a full anatomic and morphologic definition of arteries and lesions from the infrarenal abdominal aorta down to the arteries of the feet.

In cases with suboptimal MR or CT image quality or incomplete vascular definition, diagnostic angiography is prescribed to complete the study and to allow definitive statements. In patients with complex multilevel PAD, diagnostic angiography with intervention stand by might be preferable, allowing a single-stage definitive assessment and treatment decisions. (Schneider)

In the world of modern angiography, many different purposes can be accomplished, the most important ones are**:** strategic planning and guiding endovascular interventions. Arteriography presently provides much of the information used for the strategic planning of vascular reconstruction. It is still the most common strategic method with which most vascular specialists are familiar and comfortable. Once endovascular therapy has been selected as the treatment approach of choice, arteriography is the best way to guide the intervention. Intermittent periprocedural arteriography is crucial to guide wire and device passage and assessment of the results of treatment. (Schneider)

Angioplasty/stenting

The number of percutaneous transluminal angioplasties performed for claudication has risen steeply in recent years. Percutaneous transluminal angioplasty seems best suited for stenoses or short occlusions of the iliac and superficial femoral vessels, with one-year patency rates of

90% and 80% respectively.

Angioplasty provides the best results in short lesions, preferably stenosis and non-calcified lesions in the common iliac artery. Its long-term results in these situations are good, with permeability figures of 70% at 5 years for patients with claudication41. However, when it is performed in longer lesions, especially when complete occlusions are recanalized, the permeability is clearly lower. The advantages of implanting a stent in iliac angioplasties have been assessed in clinical trials, with permeability figures just a little better for systematic stenting as compared with simple balloon angioplasty42-44. The best approach is probably to implant a stent selectively in those patients in whom balloon angioplasty shows an initially suboptimal result.

In general, we can say that short lesions, less than 10 cm, preferably with stenosis, are the most suitable for endovascular treatment45-48, especially angioplasty, whereas stents have shown a high rate of fractures with important clinical consequences. In longer lesions, the use of expanded polytetrafluoroethylene coated stents seems to afford advantages over the other methods, though randomized studies with a greater follow-up are required49. (Serrano & Conejero)

Evidence suggests that balloon angioplasty is the procedure of choice for iliac and femoropoliteal artery occlusive lesions. Stent placement should be reserved for angioplasty failures. However, primary stent placement is indicated in total occlusions.

TASC lesions type A and B are best treated with angioplasty and stenting, while TASC lesions type C and D show better results with surgical treatment. (Brountzos)

Table 4- Classification of femoropopliteal lesions (TASC II), Serrano Hernando F J et al. Peripheral Artery Disease: Pathophysiology, Diagnosis, and Treatment

Type A Lesions	• Single Stenosis ≤ 10 cm • Single Oclusion ≤ 5 cm
Type B Lesions	• Multiple Lesions each ≤ 5 cm • Single Stenosis or Oclusions ≤ 15 cm (not Involving the Infrageniculate Popliteal Artery) • Single or Multiple Lesions in the Absence of continuous Tibial Vessels to Improve Inflow for a Distal Bypass • Heavily Calcified Oclusion ≤ 5 cm • Single Popliteal Stenosis
Type C Lesions	• Multiple Stenosis or Oclusion Totaling > 15 cm With or Without Heavy Calcification • Recurrent Stenoses or Oclusions That Need Treatment After 2 Endovascular Interventions
Type D Lesions	• Chronic total Oclusions of CFA or SFA (> 20 cm, Involving the Popliteal Artery) • Chronic Total Oclusion of Popliteal Artery and Proximal Trifurcation Vessels

Indications for Surgery

The indication for surgical treatment (conventional or endovascular) of PAD depends above all on the joint evaluation of 2 fundamental aspects, the clinical situation of the patient and the vascular bed that requires reconstruction (Table 4).

The clearest indication for revascularization is the patient with advanced stages of ischemia (III and IV), due to the high risk of loss of limb resulting from these situations. (Serrano & Conejero)

The development of new endovascular techniques has resulted in debate about their role in occlusive arterial disease. An expert group has drawn up a document dealing with the recommendations for treatment, known as the TASC (Inter-Society Consensus for the Management of Peripheral Arterial Disease), whose first edition was published in 2000 and with a second revision announced in 2007. This document includes multiple recommendations about the treatment of patients with PAD and establishes 4 categories (A, B, C, and D), according to the morphology and extension of the disease. (Serrano & Conejero)

Differential diagnosis of leg pain

Most leg pain results from different conditions, from wear and tear, overuse, or injuries in joints or bones or in muscles, ligaments, tendons or other soft tissues. Some types of leg pain can be traced to problems in lower spine. Blood clots, varicose veins or poor circulation can also cause leg pain.

In all cases of suggested PAD, nonvascular causes of symptoms (pseudo claudication) such as nerve root compression, spinal stenosis, hip arthritis, and others must be considered and excluded.

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