

2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with the European Society for Vascular Surgery (ESVS)



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Endorsed by the European Stroke Organization (ESO)

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Classes of recommendations

Classes of recommendations	Definition	Suggested wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended/ is indicated.
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.	
<i>Class IIa</i>	<i>Weight of evidence/opinion is in favour of usefulness/efficacy.</i>	Should be considered.
<i>Class IIb</i>	<i>Usefulness/efficacy is less well established by evidence/opinion.</i>	May be considered.
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended.

Level of evidence

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

What is new in the 2017 PAD Guidelines?

Change in recommendations	
2011	2017
Carotid Artery Disease	
EPDs in carotid stenting	
Asymptomatic 60-99% carotid stenosis	
<ul style="list-style-type: none">• Surgery for all	<ul style="list-style-type: none">• Surgery for high stroke risk
<ul style="list-style-type: none">• Stenting as an alternative	<ul style="list-style-type: none">• Stenting in high surgery risk• Stenting in average surgical risk



What is new in the 2017 PAD Guidelines? (continued)

2017 New recommendations

Carotid Artery Disease

- Coronary angiography before elective carotid surgery
- Routine prophylactic revascularization of asymptomatic carotid 70-99% stenosis in patients undergoing CABG

I

IIa

IIb

III

What is new in the 2017 PAD Guidelines? (continued)

Change in recommendations	
2011	2017
Upper Extremity Artery Disease	
Revascularization for symptomatic subclavian artery stenosis	
Subclavian stenosis revascularization	
• Endovascular first	• Stenting or surgery
Revascularization for asymptomatic subclavian stenosis in patients with/planned for CABG	



What is new in the 2017 PAD Guidelines? (continued)

Change in recommendations

2011

2017

Renal Artery Disease

Stenting for symptomatic atherosclerotic stenosis >60%

2017 New recommendations

Renal Artery Disease

- Fibromuscular dysplasia: balloon angioplasty with bailout stenting

I

IIa

IIb

III

What is new in the 2017 PAD Guidelines? (continued)

Change in recommendations	
2011	2017
Lower Extremity Artery Disease	
Aorto-iliac lesions	
<ul style="list-style-type: none"> Primary endovascular therapy for "TASC-D" 	<ul style="list-style-type: none"> Surgery in aorto-iliac or -bi-femoral occlusions
	<ul style="list-style-type: none"> Endovascular as an alternative in experienced centres
Infra-popliteal lesions	
<ul style="list-style-type: none"> Endovascular first 	<ul style="list-style-type: none"> Bypass using GSV
	<ul style="list-style-type: none"> Endovascular therapy



What is new in the 2017 PAD Guidelines? (continued)

2017 New recommendations (continued)

Lower Extremity Artery Disease (LEAD)

- Statins to improve walking distance
- LEAD + AF: Anticoagulation if CHADS-VASc >2
- Angiography in CLTI with below-the-knee lesions
- Duplex screening for AAA
- In case of CABG: screen LEAD with ABI, limit vein harvesting if LEAD

I

IIa

IIb

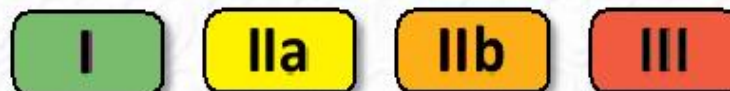
III

What is new in the 2017 PAD Guidelines? (continued)

2017 New recommendations (continued)

Lower Extremity Artery Disease (LEAD)

- Screening for LEAD in CAD patients
- Screening for LEAD in HF patients
- Clopidogrel preferred over aspirin
- Antiplatelet therapy in isolated asymptomatic LEAD

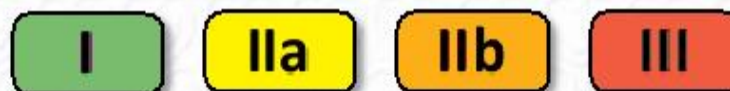


What is new in the 2017 PAD Guidelines? (continued)

2017 New recommendations

Mesenteric Artery Disease

- D-dimers to rule out acute mesenteric ischaemia
- No delay for re-nutrition in case of symptomatic Chronic Mesenteric Ischaemia



What is new in the 2017 PAD Guidelines? (continued)

2017 New recommendations

All Peripheral Arterial Diseases (PADs)

- Screening for heart failure (BNP, TTE)
- Stable PADs + other conditions requiring anticoagulants (e.g. AF):
anticoagulation alone

I

IIa

IIb

III

What is new in the 2017 PAD Guidelines? (continued)

2017 New/Revised concepts

PADs in general:

- “Vascular Team” for a multidisciplinary management.
- Best medical therapy: drugs and non pharmacological interventions for optimal outcome. A specific chapter addresses antithrombotic therapies in different PADs presentations, including when anticoagulants are needed.

What is new in the 2017 PAD Guidelines? (continued)

2017 New/Revised concepts

Carotid disease:

- Risk stratification for asymptomatic carotid disease.
- In patients undergoing CABG, revascularization of severe carotid stenosis is not systematic.

What is new in the 2017 PAD Guidelines? (continued)

2017 New/Revised concepts

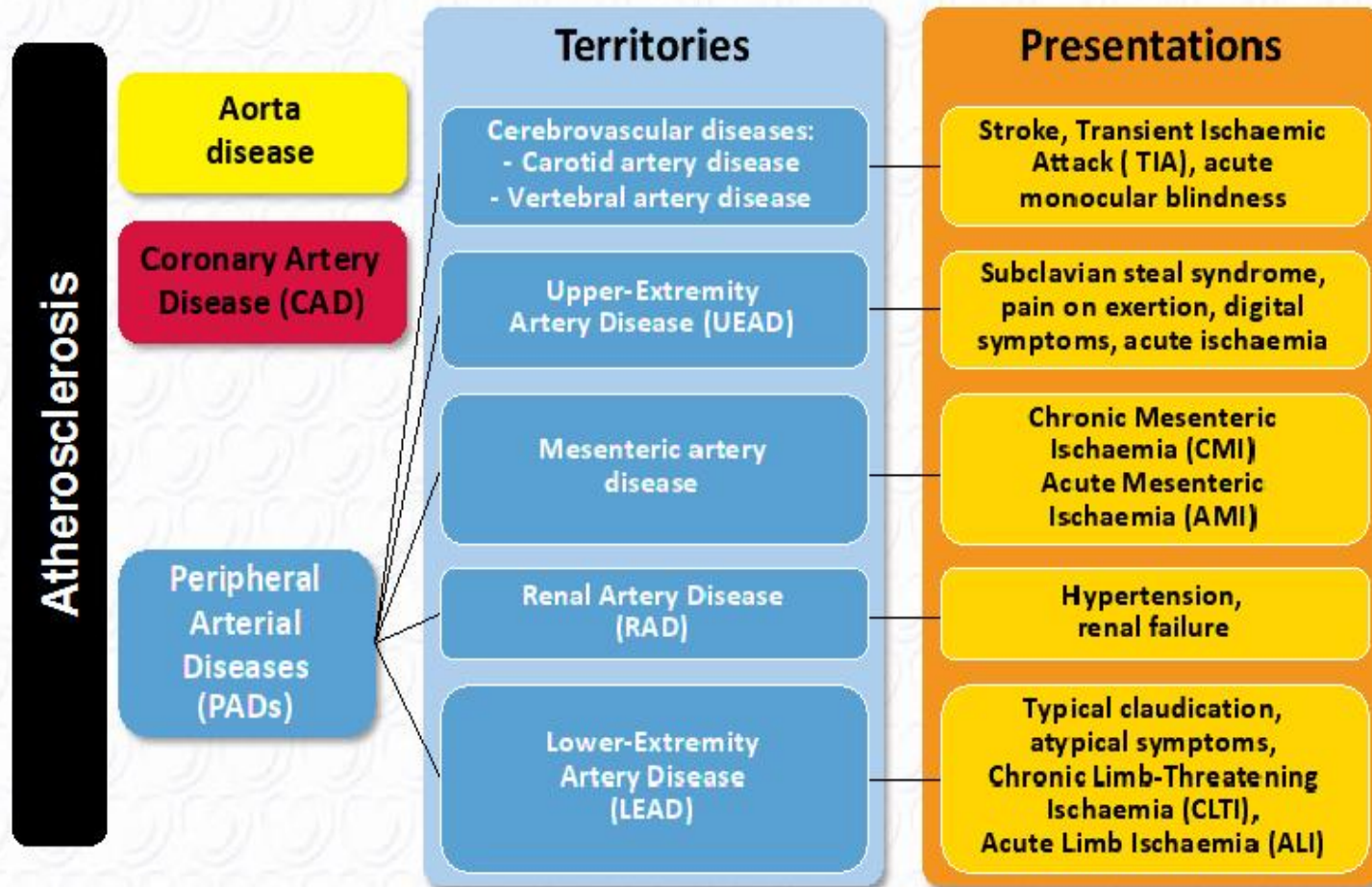
Lower extremity artery disease:

- Masked LEAD should be individualized from asymptomatic disease.
- Modern management of claudication: statins and (supervised) exercise therapy always prescribed, even after revascularization. In this context, the benefit from “vaso-active” drugs to improve walking distance is uncertain.
- “Chronic limb-threatening ischaemia (CLTI)” defines the most severe form of LEAD. Beyond ischaemia, wound and infection should be evaluated to stratify the amputation risk (new Wifl classification). TASC classification excluded from the guidelines.
- Beyond concomitant CAD, patients with PADs have often other cardiac conditions (e.g. HF, AF). The major scenarios have been addressed in a specific new chapter.

Management of patients with peripheral arterial diseases

Recommendations	Class	Level
In healthcare centres, it is recommended to set up a multi-disciplinary Vascular Team to make decisions for the management of patients with PADs.	I	C
It is recommended to implement and support initiatives to improve medical and public awareness of PADs, especially cerebrovascular and lower extremity artery diseases.	I	C

Presentations of Peripheral Arterial Diseases (PADs)



Main points of medical history for assessment of peripheral arterial diseases

Family history of CVD (coronary artery disease, cerebrovascular disease, aortic aneurysm, LEAD), and premature CVD (fatal or non-fatal CVD event or/and established diagnosis of CVD in first degree male relatives before 55 years or female relatives before 65 years).

Personal history of:

- Hypertension
- Diabetes
- Dyslipidaemia
- Smoking (present and/or past), passive smoking exposure
- Chronic kidney disease
- Sedentary life
- Dietary habits
- History of cancer radiation therapy
- Psycho-social factors
- Prior CVD

Transient or permanent neurological symptoms.

Arm exertion pain, particularly if associated with dizziness or vertigo.

Symptoms suggesting angina, dyspnoea.

Main points of medical history for assessment of peripheral arterial diseases *(continued)*

Abdominal pain, particularly if related to eating and associated with weight loss.

Walking impairment/ Claudication:

- type: fatigue, aching, cramping, discomfort, burning,
- location: buttock, thigh, calf, or foot,
- timing: triggered by exercise, uphill rather than downhill, quickly relieved with rest; chronic,
- distance.

Lower limb pain (including foot) at rest, and evolution at upright or recumbent position.

Poorly healing wounds of the extremities.

Physical activity assessment:

- functional capacity and causes of impairment.

Erectile dysfunction.

Physical examination for assessment of peripheral arterial diseases

Auscultation and palpation of cervical and supraclavicular areas.

Careful inspection of upper extremities, including hands (i.e. colour, skin integrity).

Palpation of upper extremity pulses.

Blood pressure measurement of both arms and notation of inter-arm difference.

Auscultation at different levels including the flanks, peri-umbilical region, and groin.

Abdominal palpation, palpation of femoral, popliteal, dorsalis pedis, and posterior tibial artery pulses, temperature gradient assessment.

Physical examination for assessment of peripheral arterial diseases *(continued)*

Careful inspection of lower limbs, including feet (i.e. colour, presence of any cutaneous lesion). Findings suggestive of lower extremity arterial disease, including calf hair loss and muscle atrophy, should be noted.

Peripheral neuropathy assessment in case of diabetes or LEAD: sensory loss (monofilament testing), ability to detect pain and light touch (sharp examination pin, cotton wool), vibration impairment (128 Hz tuning fork); deep tendon reflexes examination; sweating.

Laboratory testing in patients with peripheral arterial diseases

Routine tests

Fasting plasma glucose.

Fasting serum lipid profile:

- total cholesterol,
- triglycerides,
- high-density lipoprotein cholesterol,
- low-density lipoprotein cholesterol.

Serum creatinine and creatinine clearance.

Urine analysis: urinary protein by dipstick test, microalbuminuria.

- Blood count.
- Uric acid.

Laboratory testing in patients with peripheral arterial diseases *(continued)*

Additional tests, based on findings from clinical history, physical examination and routine tests

Either glycated haemoglobin if fasting plasma glucose >5.6 mmol/L (101 mg/dL) or impaired glucose tolerance test when there is doubt.

Lipoprotein(a) if there is a family history of premature cardiovascular disease.

Quantitative proteinuria if positive dipstick test.

The Ankle-Brachial Index

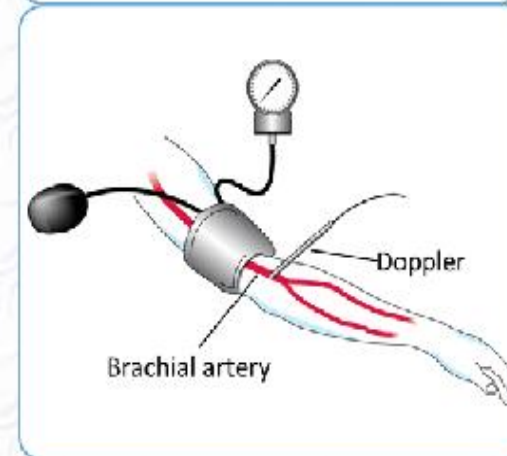
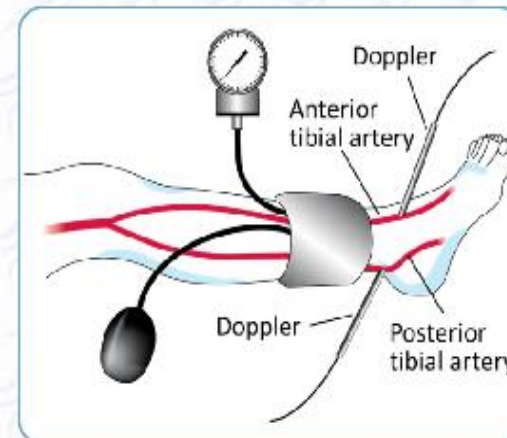
1. Who should have an ABI measurement in clinical practice?

- Patients with clinical suspicion for LEAD:
 - lower extremities pulse abolition and/or arterial bruit,
 - typical intermittent claudication or symptoms suggestive for LEAD,
 - non-healing lower extremity wound.
- Patients at risk for LEAD because of the following clinical conditions:
 - atherosclerotic diseases: CAD, any PADs,
 - other conditions: AAA, CKD, heart failure.
- Asymptomatic individuals clinically-free but at-risk for LEAD:
 - men and women aged >65 years,
 - men and women aged <65 years classified at high CV risk according the ESC Guidelines,
 - men and women aged >50 years with family history for LEAD.

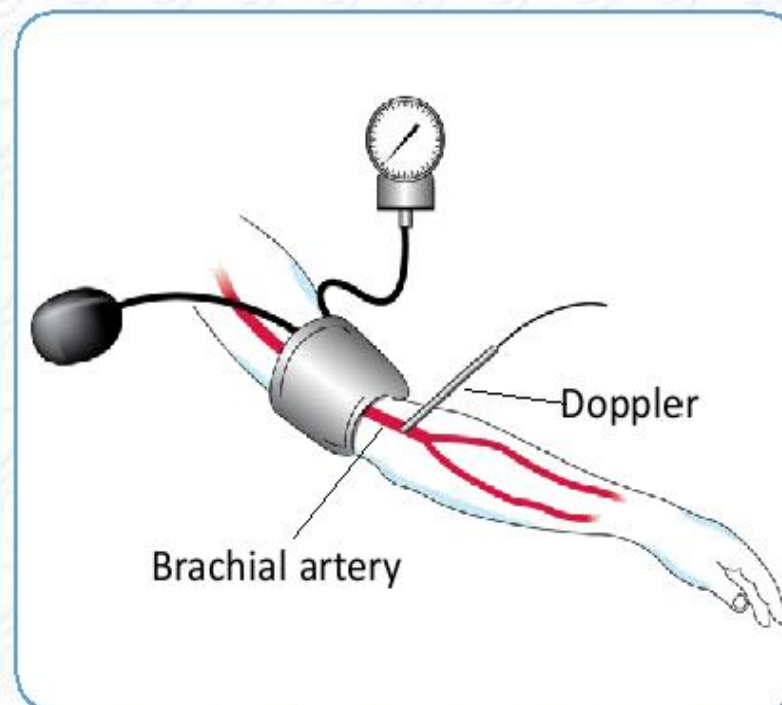
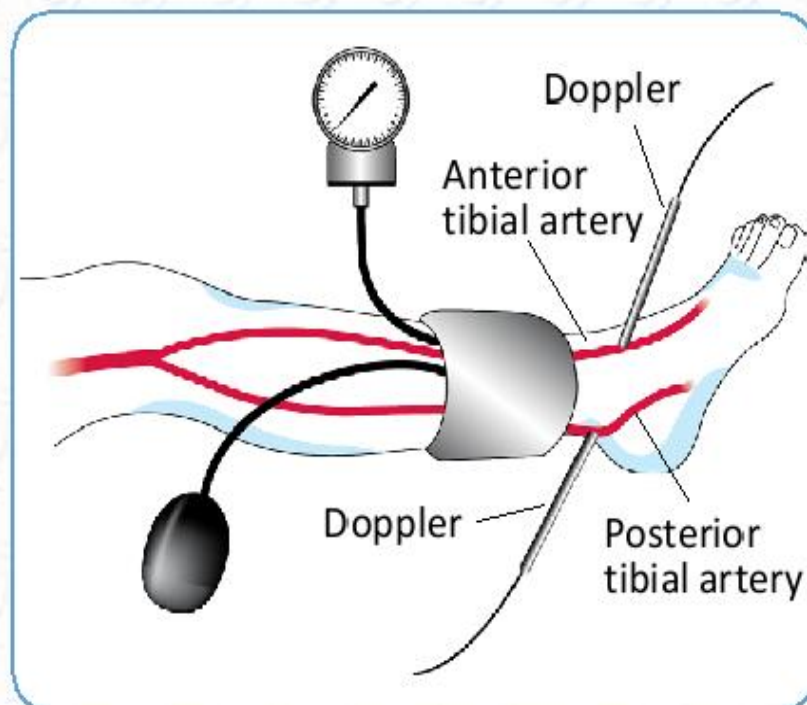
The Ankle-Brachial Index (*continued*)

2. How to measure the ABI?

Supine position, cuff placed just above the ankle, avoid wounded zones. After a 5-10 minute rest, the SBP is measured by a Doppler probe (5-10 MHz) on the posterior and the anterior tibial (or dorsal pedis) arteries of each foot and on the brachial artery of each arm. Automated BP cuffs are mostly not valid for ankle pressure and may overestimate results in case of low ankle pressure. The ABI of each leg is calculated by dividing the highest ankle SBP by the highest arm SBP.



The Ankle-Brachial Index (*continued*)



The Ankle-Brachial Index *(continued)*

3. How to interpret the ABI?

- For diagnosis of LEAD interpret each leg separately (one ABI per leg).
- For the CV risk stratification: take the lowest ABI between the two legs.
- Interpretation:



Patients with peripheral arterial diseases: best medical therapy

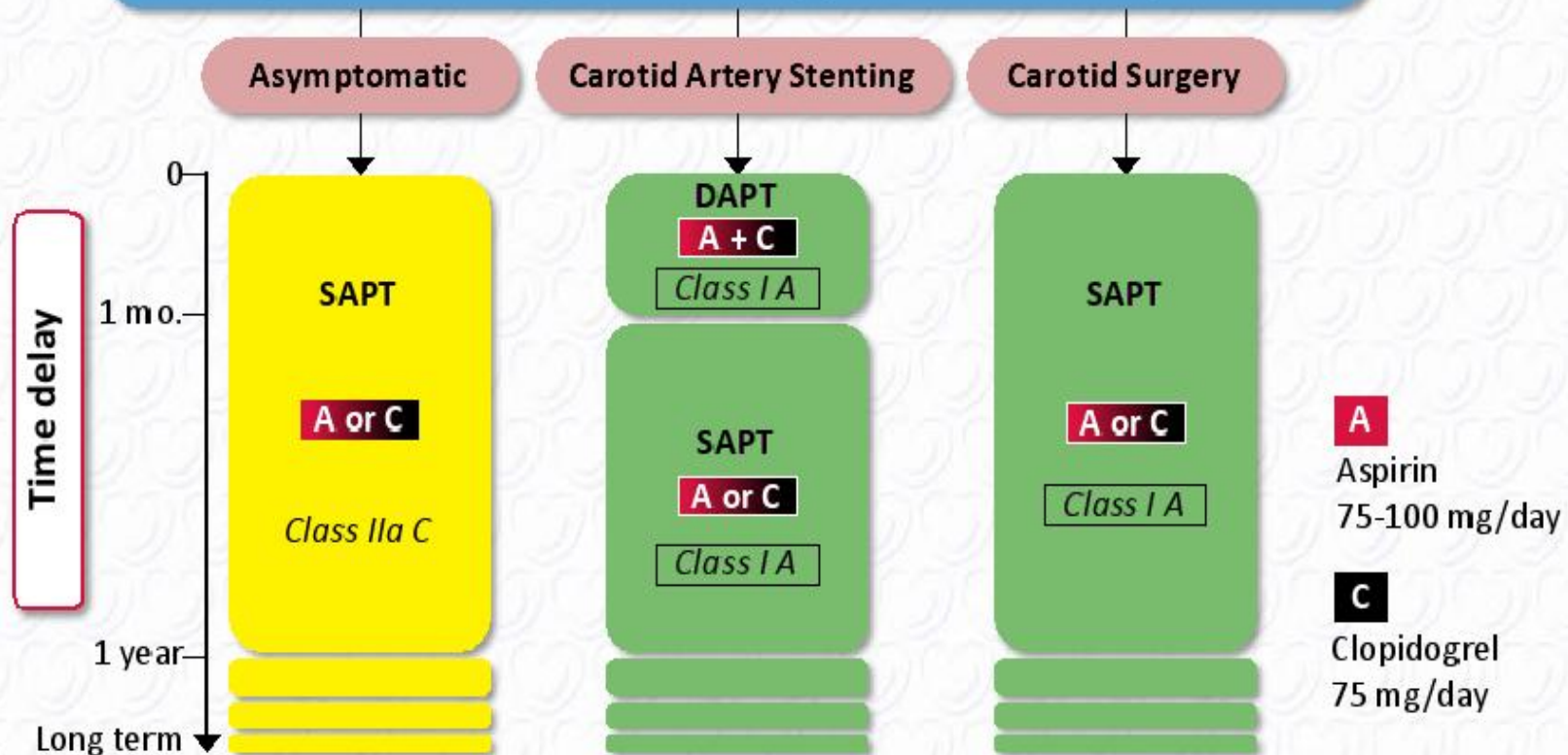
Recommendations	Class	Level
Smoking cessation is recommended in all patients with PADs.	I	B
Healthy diet and physical activity are recommended for all patients with PADs.	I	C
Statins are recommended in all patients with PADs.	I	A
In patients with PADs, it is recommended to reduce LDL-C to <1.8 mmol/L (70 mg/dL) or decrease it by $\geq 50\%$ if baseline values are 1.8-3.5 mmol/L (70-135 mg/dL).	I	C

Patients with peripheral arterial diseases: best medical therapy *(continued)*

Recommendations	Class	Level
In diabetic patients with PADs, strict glycaemic control is recommended.	I	C
Antiplatelet therapy is recommended in patients with symptomatic PADs.	I	C
In patients with PADs and hypertension, it is recommended to control blood pressure at <140/90 mmHg.	I	A
ACEIs or ARBs should be considered as first line therapy in patients with PADs and hypertension.	Ila	B

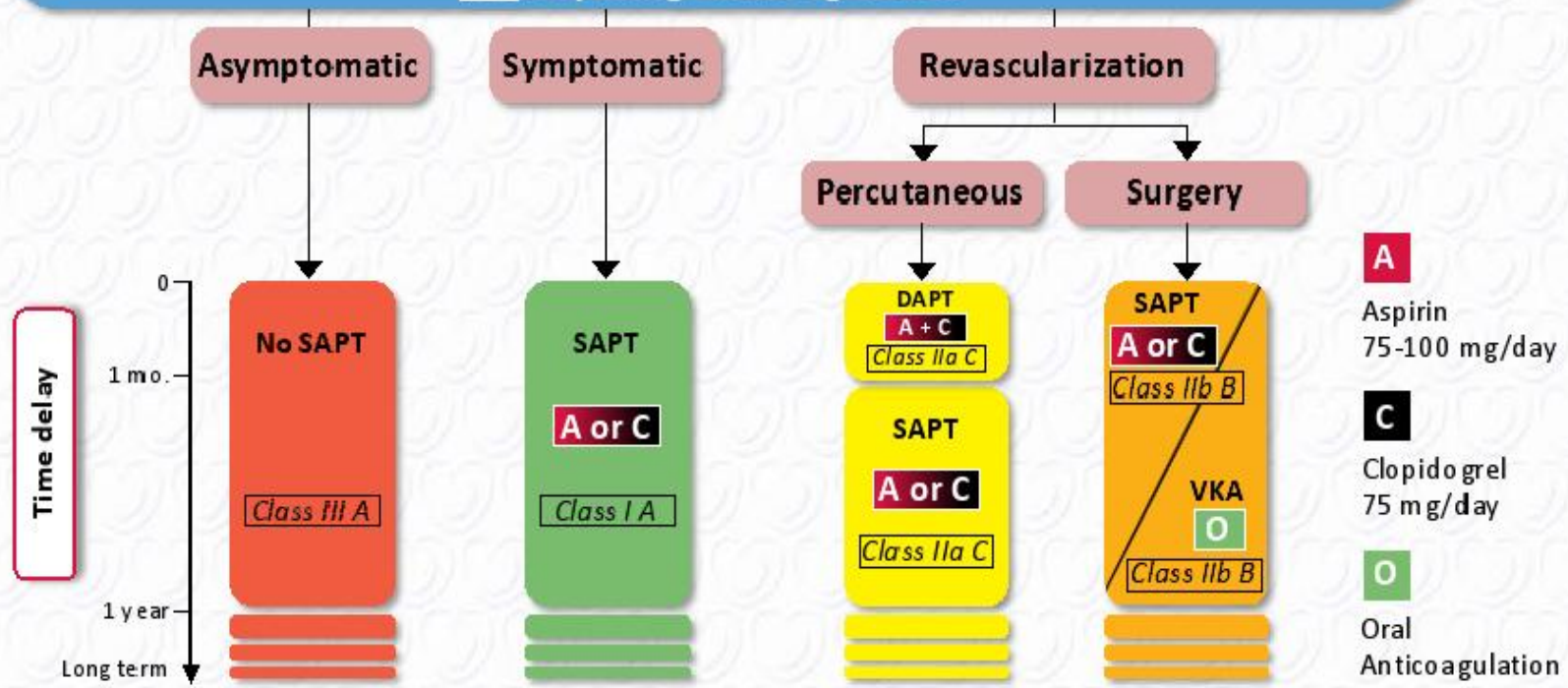
Management of antithrombotic treatment in patients with carotid artery stenosis

Management of antiplatelet therapy in carotid artery stenosis

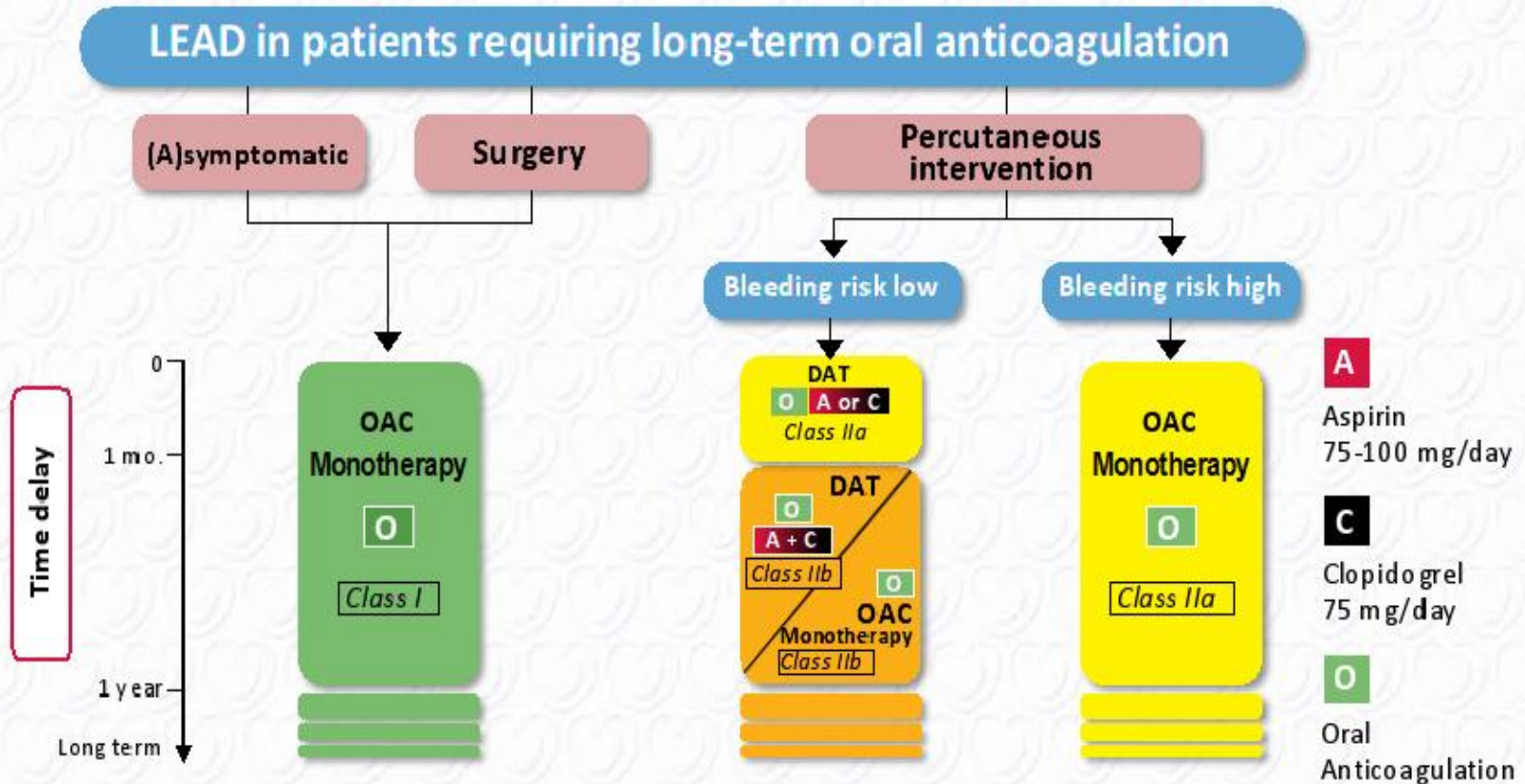


Antiplatelet therapy in patients with lower extremity artery disease

Management of antiplatelet therapy in patients with LEAD not requiring anticoagulation



Antithrombotic therapy in patients with LEAD requiring oral anticoagulation



Antithrombotic therapy in patients with peripheral artery diseases

Recommendations	Class	Level
Carotid artery disease		
In patients with symptomatic carotid stenosis, long-term SAPT is recommended.	I	A
DAPT with aspirin and clopidogrel is recommended for at least one month after CAS.	I	B
In patients with asymptomatic >50% CAS, long-term anti-platelet therapy (commonly low dose aspirin) should be considered when the bleeding risk is low.	Ila	C
Lower extremity artery disease		
Long-term SAPT is recommended in symptomatic patients.	I	A
Long-term SAPT is recommended in all patients who have undergone revascularization.	I	C

Antithrombotic therapy in patients with peripheral artery diseases *(continued)*

Recommendations	Class	Level
Lower extremity artery disease <i>(continued)</i>		
SAPT is recommended after infra-inguinal bypass surgery.	I	A
In patients requiring antiplatelet therapy, clopidogrel may be preferred over aspirin.	IIb	B
Vitamin K antagonists may be considered after autologous vein infrainguinal bypass.	IIb	B
DAPT with aspirin and clopidogrel for at least one month should be considered after infra-inguinal stent implantation.	IIa	C
DAPT with aspirin and clopidogrel may be considered in below-knee bypass with prosthetic graft.	IIb	B

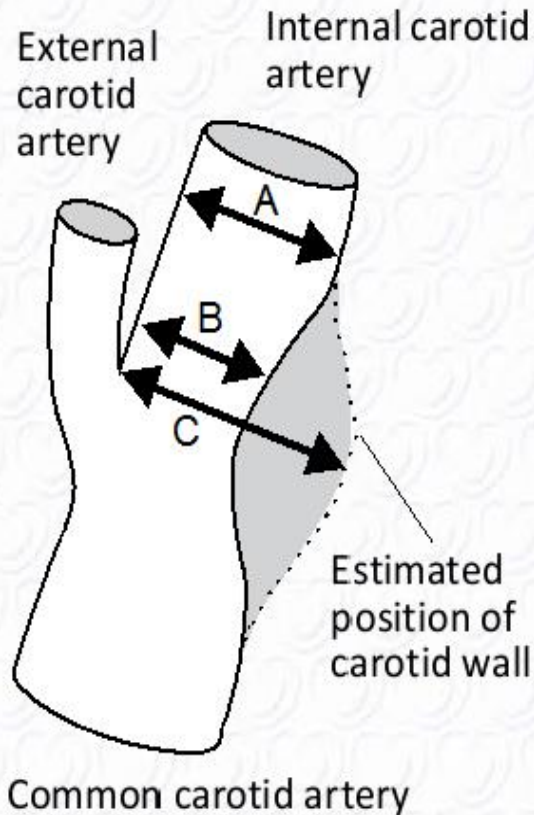
Antithrombotic therapy in patients with peripheral artery diseases *(continued)*

Recommendations	Class	Level
Lower extremity artery disease <i>(continued)</i>		
Because of a lack of proved benefit, antiplatelet therapy is not routinely indicated in patients with isolated asymptomatic LEAD.	III	A
Antithrombotic therapy for PADs patients requiring oral anticoagulant		
In patients with PADs and AF, oral anticoagulation:		
• is recommended when CHA ₂ DS ₂ -VASc score ≥2,	I	A
• should be considered in all other patients.	IIa	B
In patients with PADs who have an indication for OAC (e.g. AF or mechanical prosthetic valve), oral anticoagulants alone should be considered.	IIa	B

Antithrombotic therapy in patients with peripheral artery diseases (*continued*)

Recommendations	Class	Level
Antithrombotic therapy for PADs patients requiring oral anticoagulant (<i>continued</i>)		
After endovascular revascularization, aspirin or clopidogrel should be considered in addition to OAC for at least 1 month if the bleeding risk is low compared to the risk of stent/graft occlusion.	IIa	C
After endovascular revascularization, OAC alone should be considered if the bleeding risk is high compared to the risk of stent/graft occlusion.	IIa	C
OAC and SAPT may be considered beyond one month in high ischaemic risk patients or when there is another firm indication for long-term SAPT.	IIb	C

Angiographic carotid stenosis according to different methods



NASCET $\frac{A - B}{A}$		ECST $\frac{C - B}{C}$	
NASCET		ECST	
30		65	
40		70	
50		75	
60		80	
70		85	
80		91	
90		97	

Approximate equivalent degrees of internal carotid artery stenosis used in NASCET and ECST according to recent comparisons.

Imaging of extracranial carotid arteries

Recommendations	Class	Level
DUS (as first-line), CTA and/or MRA are recommended for evaluating the extent and severity of extracranial carotid stenoses.	I	B
When CAS is being considered, it is recommended that any DUS study be followed either by MRA or CTA to evaluate the aortic arch, as well as the extra- and intracranial circulation.	I	B
When CEA is considered, it is recommended that the DUS stenosis estimation be corroborated either by MRA or CTA (or by a repeat DUS study performed in an expert vascular laboratory).	I	B

Management of asymptomatic carotid artery disease

Recommendations	Class	Level
In “ average surgical risk ” patients with an asymptomatic 60-99% stenosis, CEA should be considered in the presence of clinical and/or more imaging characteristics that may be associated with an increased risk of late ipsilateral stroke, provided documented perioperative stroke/death rates are <3% and the patient’s life expectancy is >5 years.	Ia	B
In asymptomatic patients who have been deemed “ high-risk for CEA ” and who have an asymptomatic 60-99% stenosis in the presence of clinical and/or imaging characteristics that may be associated with an increased risk of late ipsilateral stroke, CAS should be considered, provided documented perioperative stroke/death rates are <3% and the patient’s life expectancy is >5 years.	Ia	B

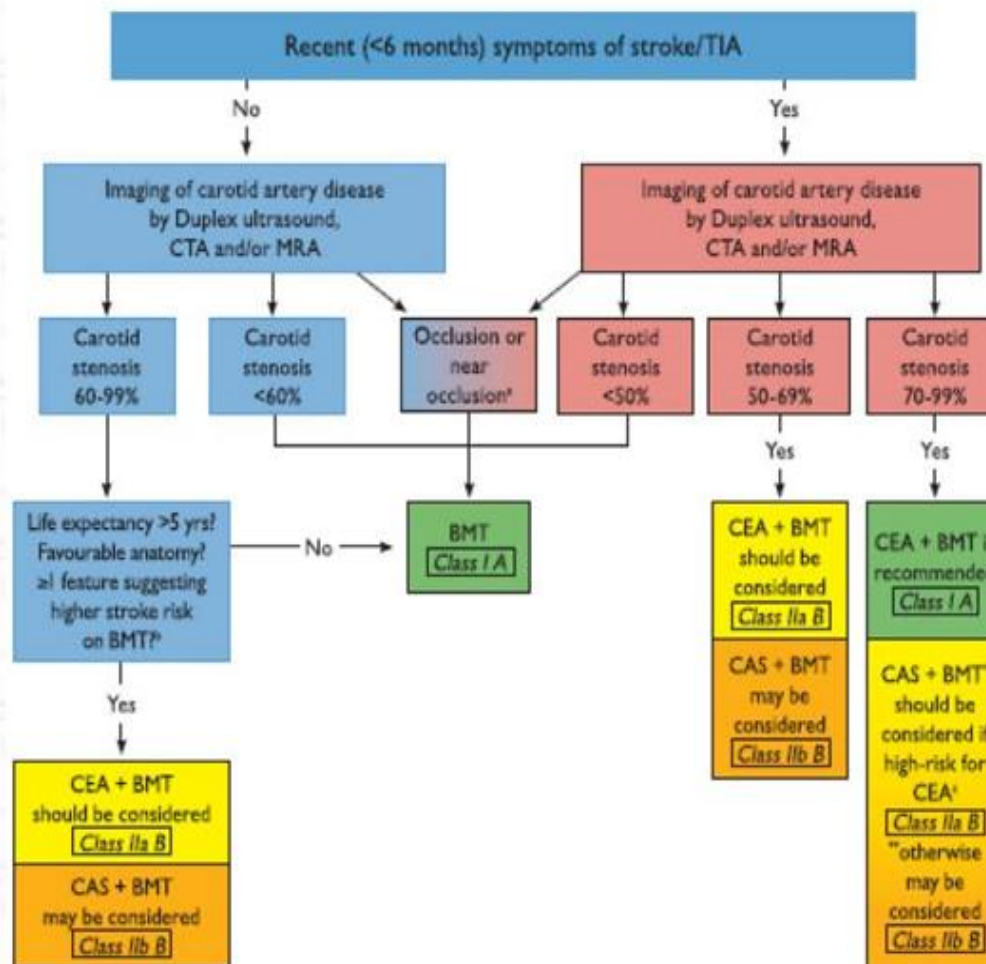
Management of asymptomatic carotid artery disease (*continued*)

Recommendations	Class	Level
In “average surgical risk” patients with an asymptomatic 60-99% stenosis in the presence of clinical and/or imaging characteristics ^d that may be associated with an increased risk of late ipsilateral stroke, CAS may be an alternative to CEA provided documented perioperative stroke/death rates are <3% and the patient’s life expectancy is >5 years.	IIb	B

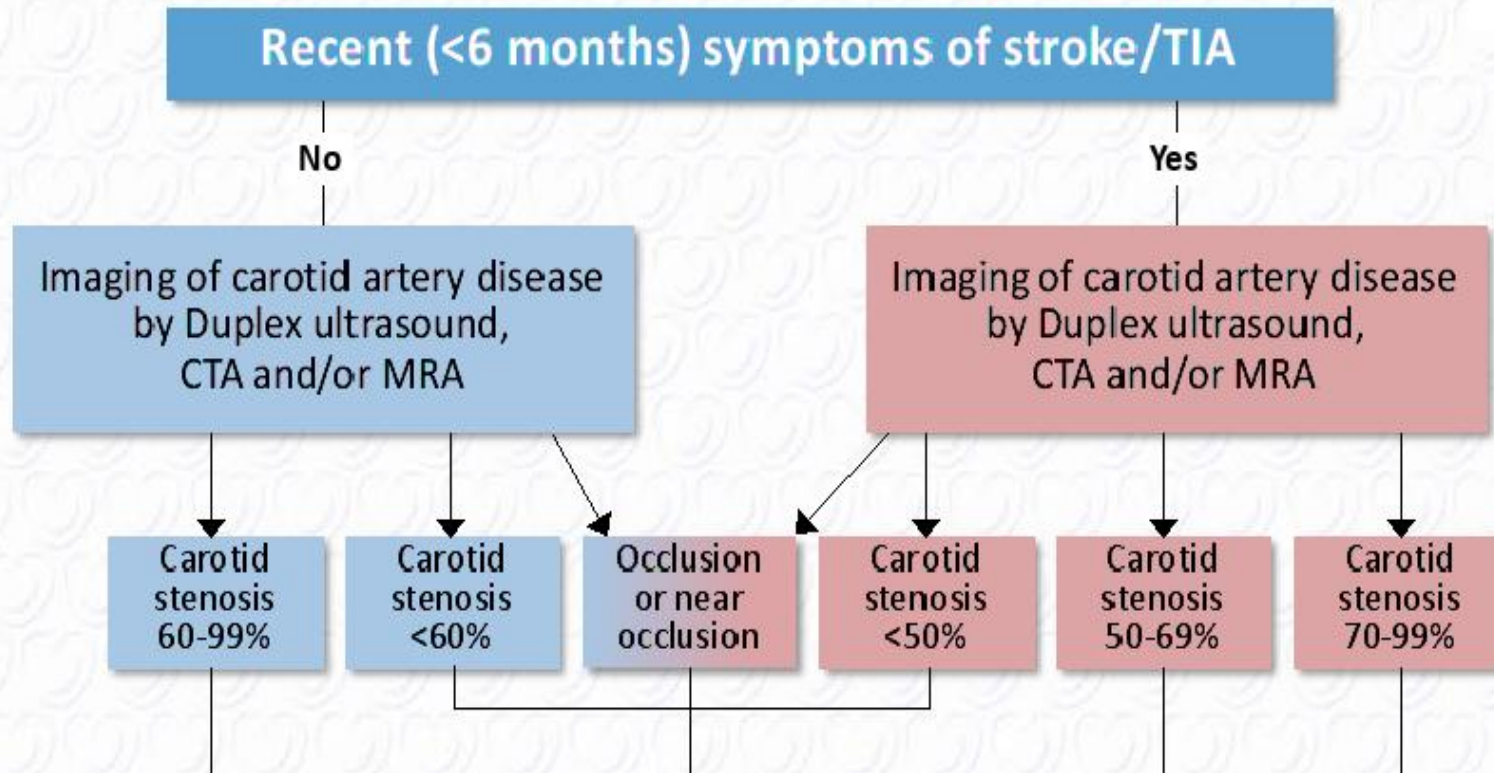
Features associated with increased risk of stroke in patients with asymptomatic carotid stenosis treated medically

Clinical	<ul style="list-style-type: none">• Contralateral TIA/stroke
Cerebral imaging	<ul style="list-style-type: none">• Ipsilateral silent infarction
Ultrasound imaging	<ul style="list-style-type: none">• Stenosis progression (> 20%)• Spontaneous embolization on transcranial Doppler (HITS)• Impaired cerebral vascular reserve• Large plaques• Echolucent plaques• Increased juxta-luminal black (hypoechoogenic) area
MRA	<ul style="list-style-type: none">• Intraplaque haemorrhage• Lipid-rich necrotic core

Management of extracranial carotid artery disease



Management of extracranial carotid artery disease

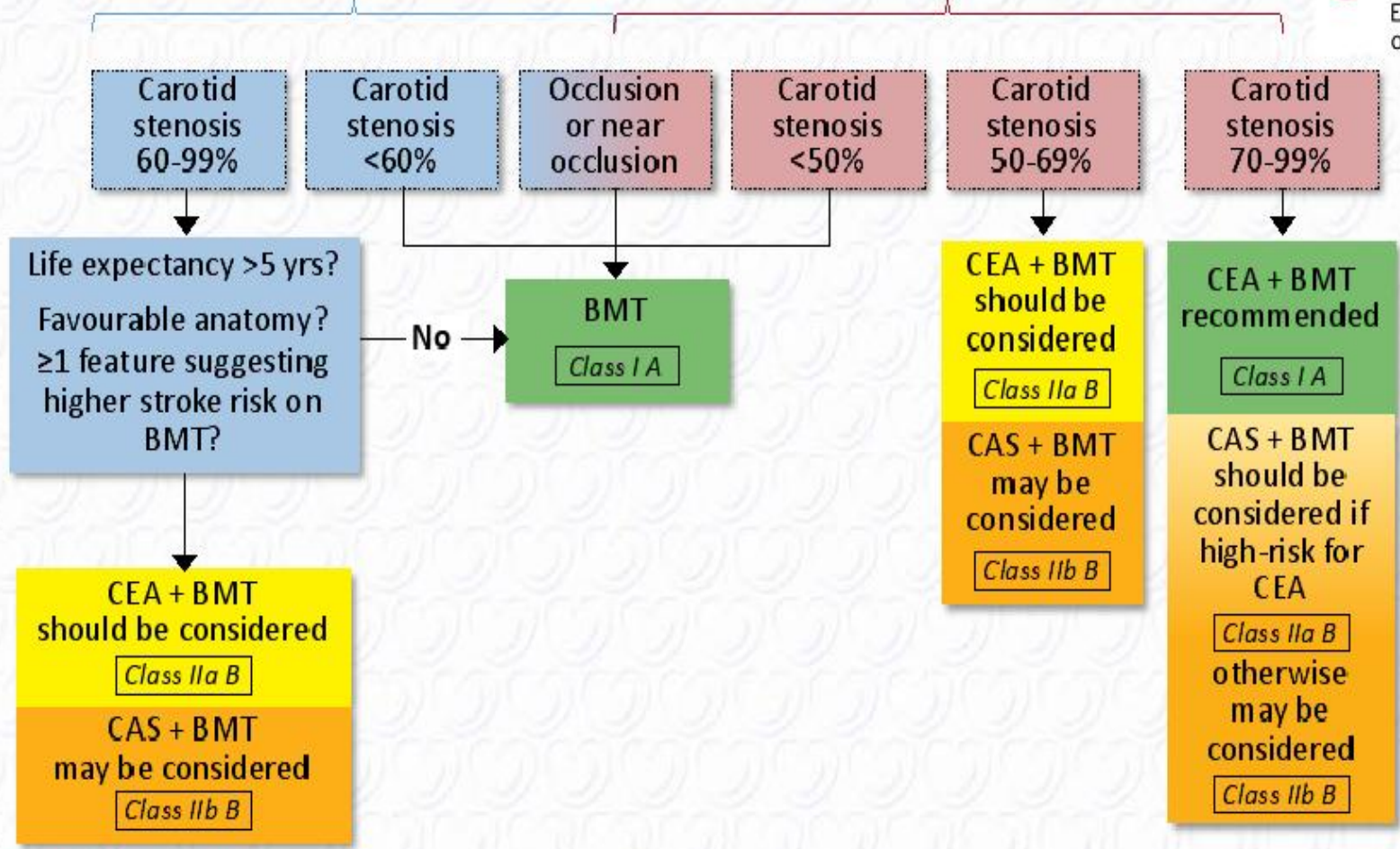


(continued)

(continued)

Asymptomatic

Symptomatic



Revascularization in patients with symptomatic carotid disease

Recommendations	Class	Level
CEA is recommended in symptomatic patients with 70-99% carotid stenoses, provided the documented procedural death/stroke rate is <6%.	I	A
CEA should be considered in symptomatic patients with 50-69% carotid stenoses, provided the documented procedural death/stroke rate is <6%.	IIa	A
In recently symptomatic patients with a 50–99% stenosis who present with adverse anatomical features or medical comorbidities that are considered to make them “high-risk for CEA”, CAS should be considered, provided the documented procedural death/stroke rate is <6%.	IIa	B

Revascularization in patients with symptomatic carotid disease *(continued)*

Recommendations	Class	Level
When revascularization is indicated in “average surgical risk” patients with symptomatic carotid disease, CAS may be considered as an alternative to surgery, provided the documented procedural death/ stroke rate is <6%.	IIb	B
When decided, it is recommended to perform revascularization of symptomatic 50–99% carotid stenoses as soon as possible, preferably within 14 days of symptom onset.	I	A
Revascularization is not recommended in patients with a <50% carotid stenosis.	III	A

Use of embolic protection device during carotid stenting

Recommendations	Class	Level
The use of embolic protection devices should be considered in patients undergoing carotid artery stenting.	Ia	C

Management of vertebral artery stenosis

Recommendations	Class	Level
In patients with symptomatic extracranial vertebral artery stenosis, revascularization may be considered for lesions $\geq 50\%$ in patients with recurrent ischaemic events, despite optimal medical management.	IIb	B
Revascularization of asymptomatic vertebral artery stenosis is not indicated, irrespective of the degree of severity.	III	C

Differential diagnosis in upper limbs artery disease

Causes	Subclavian	Axillary	Brachial	Forearm	Hand
Atherosclerosis	•				
Thoracic outlet syndrome	•				
Giant cell arteritis	•				
Takayasu arteritis	•	•			
Radiation artery fibrosis	•	•			
Embolic		•	•	•	•
Fibromuscular dysplasia		•			•
Buerger's disease				•	•
Ergotism				•	•
Connective tissue disease				•	•
Cytotoxic drugs					•
Arterial drug injection					•
Diabetes mellitus					•
Myeloproliferative disorders					•
Hypercoagulable status					•
Cryoglobulins					•
Repetitive trauma					•
Vinyl chloride exposure					•
Iatrogenic lesions	•	•	•	•	•

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Differential diagnosis in upper limbs artery disease

Causes	Subclavian	Axillary	Brachial	Forearm	Hand
Atherosclerosis	•				
Thoracic outlet syndrome	•				
Giant cell arteritis	•				
Takayasu arteritis	•	•			
Radiation artery fibrosis	•	•			
Embolic		•	•	•	•
Fibromuscular dysplasia		•			•
Buerger's disease				•	•
Ergotism				•	•
Connective tissue disease				•	•

Differential diagnosis in upper limbs artery disease *(continued)*

Causes	Subclavian	Axillary	Brachial	Forearm	Hand
Cytotoxic drugs					•
Arterial drug injection					•
Diabetes mellitus					•
Myeloproliferative disorders					•
Hypercoagulative status					•
Cryoglobulins					•
Repetitive trauma					•
Vinyl chloride exposure					•
Iatrogenic lesions	•	•	•	•	•

Management of subclavian artery stenosis

Recommendations	Class	Level
In symptomatic patients with subclavian artery stenosis/occlusion revascularization should be considered.	IIa	C
In symptomatic patients with a stenotic/occluded sub-clavian artery, both revascularization options (stenting or surgery) should be considered and discussed case by case according to the lesion characteristics and patient's risk.	IIa	C

Management of subclavian artery stenosis (continued)

Recommendations	Class	Level
In asymptomatic subclavian artery stenosis, revascularization:		
<ul style="list-style-type: none"> should be considered in the case of proximal stenosis in patients undergoing CABG using the ipsilateral internal mammary artery. 	IIa	C
<ul style="list-style-type: none"> should be considered in the case of proximal stenosis in patients who already have the ipsilateral internal mammary artery grafted to coronary arteries with evidence of myocardial ischaemia. 	IIa	C
<ul style="list-style-type: none"> should be considered in the case of subclavian artery stenosis and ipsilateral arteriovenous fistula for dialysis. 	IIa	C
<ul style="list-style-type: none"> may be considered in the case of bilateral stenosis, in order to be able to monitor blood pressure accurately 	IIb	C

Management of acute mesenteric ischaemia

Recommendations	Class	Level
Diagnosis		
In patients with suspected acute mesenteric ischaemia, urgent CTA is recommended.	I	C
In patients with suspicion of acute mesenteric ischaemia, the measurement of D-dimer should be considered to rule out the diagnosis.	Ila	B
Treatment		
In patients with acute thrombotic occlusion of the superior mesenteric artery, endovascular therapy should be considered as first line therapy for revascularization.	Ila	B
In patients with acute embolic occlusion of the superior mesenteric artery, both endovascular and open surgery therapy should be considered.	Ila	B

Management of chronic mesenteric ischaemia

Recommendations	Class	Level
Diagnosis		
In patients with suspected CMI, DUS is recommended as the first line examination.	I	C
In patients with suspected CMI, occlusive disease of a single mesenteric artery makes the diagnosis unlikely, and a careful search for alternative causes should be considered.	IIa	C
Treatment		
In patients with symptomatic multivessel CMI, revascularization is recommended.	I	C
In patients with symptomatic multivessel CMI, it is not recommended to delay revascularization in order to improve the nutritional status.	III	C

Clinical situations raising suspicion for renal artery disease

- | | |
|---|---|
| <ul style="list-style-type: none">• Onset of HTN < 30 years. | <ul style="list-style-type: none">• Hypertensive crisis (acute HF, acute renal failure, hypertensive encephalopathy, or grade 3-4 retinopathy). |
| <ul style="list-style-type: none">• Onset of severe HTN > 55 years, when associated with CKD or HF. | <ul style="list-style-type: none">• New azotaemia or worsening of renal function after treatment with RAAS blockers. |
| <ul style="list-style-type: none">• HTN and abdominal bruit. | <ul style="list-style-type: none">• Unexplained atrophic kidney or discrepancy in kidney size, or unexplained renal failure. |
| <ul style="list-style-type: none">• Rapid and persistent worsening of previously controlled HTN. | <ul style="list-style-type: none">• Flash pulmonary oedema. |
| <ul style="list-style-type: none">• Resistant HTN (other secondary form unlikely and target not achieved despite 4 drug classes including a diuretic and a mineralocorticoid-receptor antagonist in appropriate doses). | |

Recommendations	Class	Level
DUS (as first-line), CTA and MRA are recommended imaging modalities to establish a diagnosis of RAD.	I	B
DSA may be considered to confirm a diagnosis of RAD when clinical suspicion is high and the results of non-invasive examinations are inconclusive.	IIb	C
Renal scintigraphy, plasma renin measurements before and after ACEI provocation, and vein renin measurements are not recommended for screening of atherosclerotic RAD.	III	C

Treatment strategies for renal artery disease

Recommendations	Class	Level
Medical therapy		
ACEIs/ARBs are recommended for treatment of hypertension associated with unilateral RAS.	I	B
Calcium channel blockers, beta-blockers and diuretics are recommended for treatment of hypertension associated with renal artery disease.	I	C
ACEIs/ARBs may be considered in bilateral severe RAS and in the case of stenosis in a single functioning kidney, if well tolerated and under close monitoring.	IIb	B

Treatment strategies for renal artery disease (continued)

Recommendations	Class	Level
Revascularization		
Routine revascularization is not recommended in RAS secondary to atherosclerosis.	III	A
In cases of hypertension and/or signs of renal impairment related to renal arterial fibromuscular dysplasia, balloon angioplasty with bailout stenting should be considered.	IIa	B
Balloon angioplasty, with or without stenting, may be considered in selected patients with RAS and unexplained recurrent congestive heart failure or sudden pulmonary oedema.	IIb	C
In the case of an indication for revascularization, surgical revascularization should be considered for patients with complex anatomy of the renal arteries, after a failed endovascular procedure, or during open aortic surgery.	IIa	B

Clinical stages of lower extremity artery disease (LEAD)

Fontaine classification			Rutherford classification		
Stage	Symptoms		Grade	Category	Symptoms
I	Asymptomatic	↔	0	0	Asymptomatic
II	IIa Non-disabling intermittent claudication	↔	I	1	Mild claudication
			I	2	Moderate claudication
	IIb Disabling intermittent claudication		I	3	Severe claudication
III	Ischaemic rest pain	↔	II	4	Ischaemic rest pain
IV	Ulceration or gangrene	↔	III	5	Minor tissue loss
			III	6	Major tissue loss

Ankle-brachial index measurement

Recommendations	Class	Level
Measurement of the ABI is indicated as a first-line non-invasive test for screening and diagnosis of LEAD.	I	C
In the case of incompressible ankle arteries or ABI >1.40, alternative methods such as the toe-brachial index, Doppler waveform analysis or pulse volume recording are indicated.	I	C

Imaging in patients with LEAD

Recommendations	Class	Level
DUS is indicated as first-line imaging method to confirm LEAD lesions.	I	C
DUS and/or CTA and/or MRA are indicated for anatomical characterization of LEAD lesions and guidance for optimal revascularization strategy.	I	C
Data from an anatomical imaging test should always be analyzed in conjunction with symptoms and haemodynamic tests prior to treatment decision.	I	C
DUS screening for AAA should be considered.	IIa	C

Revascularization of aorto-iliac occlusive lesions

Recommendations	Class	Level
An endovascular-first strategy is recommended for short (i.e. <5 cm) occlusive lesions.	I	C
In patients fit for surgery, aorto-(bi)femoral bypass should be considered in aorto-iliac occlusion(s).	IIa	B
An endovascular-first strategy should be considered in long and/or bilateral lesions in patients with severe comorbidities.	IIa	B
An endovascular-first strategy may be considered for aorto-iliac occlusive lesions, if done by an experienced team and if it does not compromise subsequent surgical options.	IIb	B

Revascularization of aorto-iliac occlusive lesions *(continued)*

Recommendations	Class	Level
Primary stent implantation, rather than provisional stenting, should be considered.	Ila	B
Open surgery should be considered in fit patients with an aortic occlusion extending up to the renal arteries.	Ila	C
In the case of ilio-femoral occlusive lesions, a hybrid procedure combining iliac stenting and femoral endarterectomy or bypass should be considered.	Ila	C
Extra-anatomical bypass may be indicated only for patients with no other alternatives for revascularization.	Ilb	C

Revascularization of femoro-popliteal occlusive lesions

Recommendations	Class	Level
An endovascular-first strategy is recommended in short (i.e. <25 cm) lesions.	I	C
Primary stent implantation should be considered in short (i.e. <25 cm) lesions.	IIa	A
Drug-eluting balloons may be considered in short (i.e. <25 cm) lesions.	IIb	A
Drug-eluting stents may be considered for short (i.e. <25 cm) lesions.	IIb	B
Drug-eluting balloons may be considered for the treatment of in-stent restenosis.	IIb	B

Revascularization of femoro-popliteal occlusive lesions *(continued)*

Recommendations	Class	Level
In patients who are not at high-risk for surgery, bypass surgery is indicated for long (i.e. ≥ 25 cm) superficial femoral artery lesions when an autologous vein is available and life expectancy is >2 years.	I	B
The autologous saphenous vein is the conduit of choice for femoro-popliteal bypass.	I	A
When above-knee bypass is indicated, in the absence of any autologous saphenous vein, the use of a prosthetic conduit should be considered.	IIa	A
In patients unfit for surgery, endovascular therapy may be considered in long (i.e. ≥ 25 cm) femoro-popliteal lesions.	IIb	C

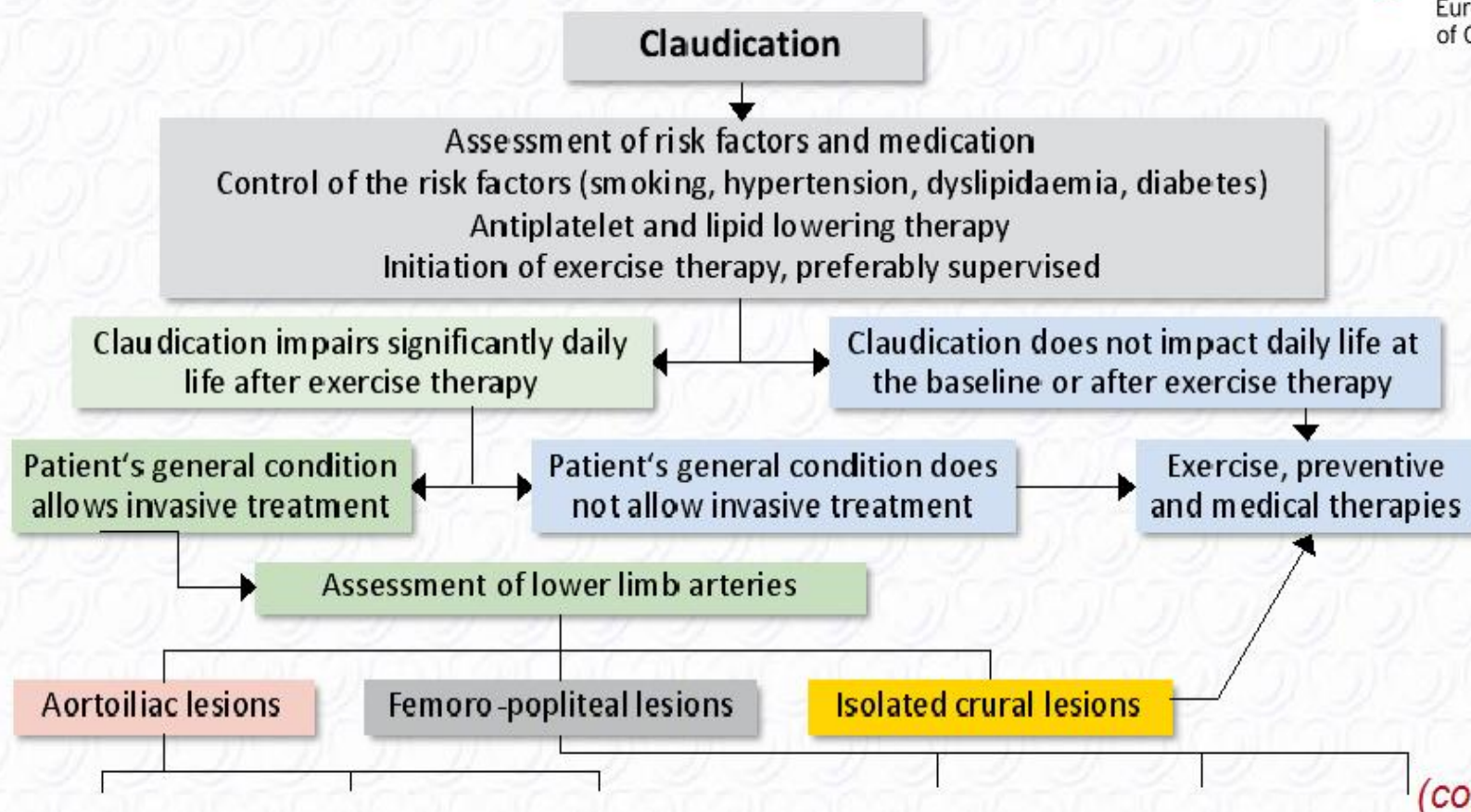
Revascularization of infra-popliteal occlusive lesions

Recommendations	Class	Level
In the case of chronic limb threatening ischaemia (CLTI), infra-popliteal revascularization is indicated for limb salvage.	I	A
For revascularization of infra-popliteal arteries:		
• bypass using the great saphenous vein is indicated,	I	A
• endovascular therapy should be considered.	Ia	B

Management of patients with intermittent claudication

Recommendations	Class	Level
On top of general prevention, statins are indicated to improve walking distance.	I	A
In patients with intermittent claudication:		
• supervised exercise training is recommended,	I	A
• unsupervised exercise training is recommended when supervised exercise training is not feasible or available.	I	C
When daily life activities are compromised despite exercise therapy, revascularization should be considered.	IIa	C
When daily life activity is severely compromised, revascularization should be considered, in association with exercise therapy.	IIa	B

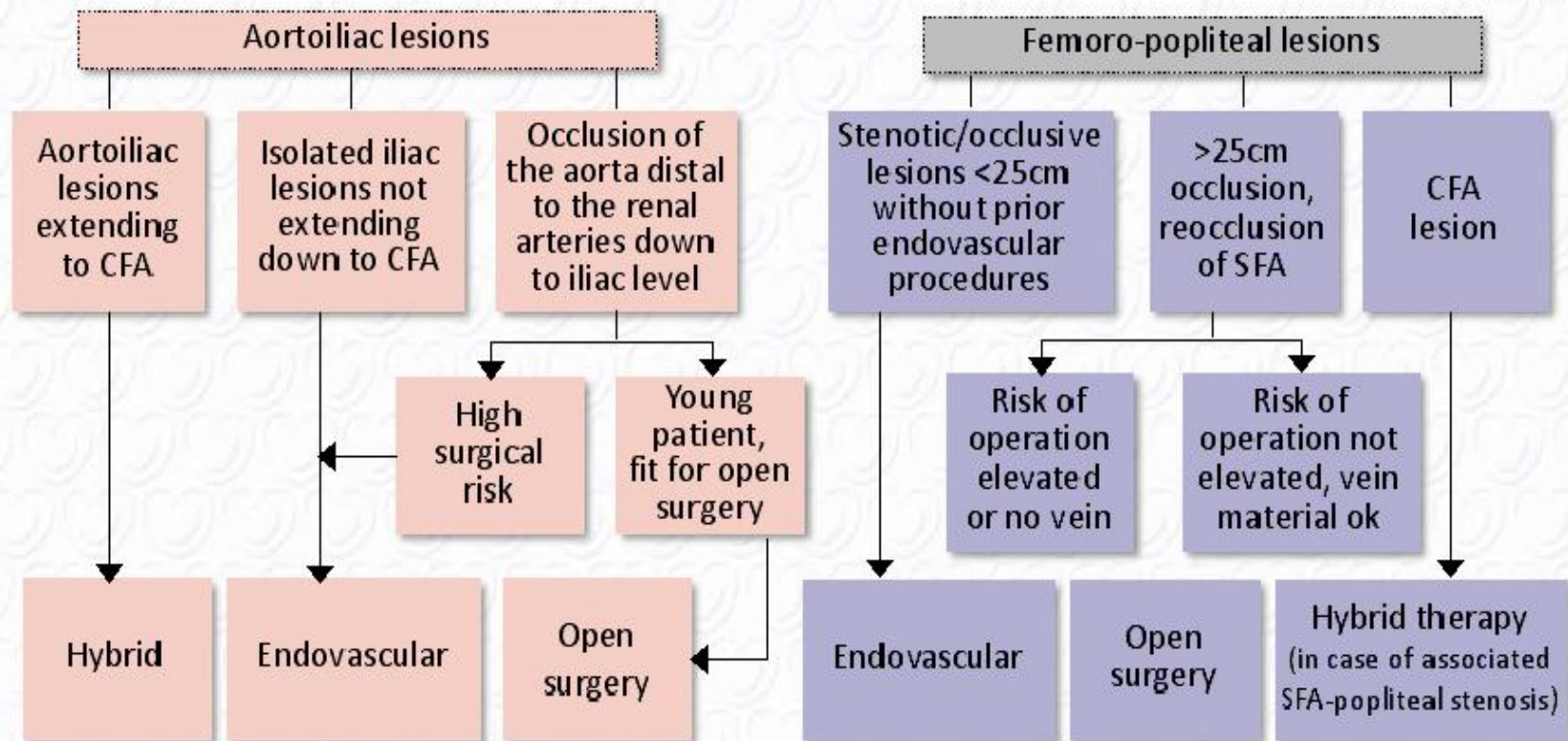
Management of patients with intermittent claudication



(continued)

Management of patients with intermittent claudication

(continued)



Post interventional exercise therapy and risk factor modification after ANY intervention

Risk of amputation: the WIFI classification



Component	Score	Description		
W (Wound)	0	No ulcer (ischaemic rest pain).		
	1	Small, shallow ulcer on distal leg or foot without gangrene.		
	2	Deeper ulcer (exposed bone), joint or tendon ± gangrenous changes limited to toes.		
	3	Extensive deep ulcer, full thickness heel ulcer ± calcaneal involvement ± extensive gangrene.		
I (Ischaemia)		ABI	Ankle pressure (mmHg)	Toe pressure or TcPO ₂
	0	≥0.80	>100	≥60
	1	0.60-0.79	70-100	40-59
	2	0.40-0.59	50-70	30-39
	3	<0.40	<50	<30
fi (foot Infection)	0	No symptoms/signs of infection.		
	1	Local infection involving only skin and subcutaneous tissue.		
	2	Local infection involving deeper than skin/subcutaneous tissue.		
	3	Systemic inflammatory response syndrome.		

Interpretation of the WIFI classification

Estimate risk of amputation at 1 year for each combination																
	Ischaemia - 0				Ischaemia - 1				Ischaemia - 2				Ischaemia - 3			
W-0	VL	VL	L	M	VL	L	M	H	L	L	M	M	L	M	M	H
W-1	VL	VL	L	M	VL	L	M	H	L	M	H	H	M	M	H	H
W-2	L	L	M	H	M	M	H	H	M	H	H	H	H	H	H	H
W-3	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H
	fl-0	fl-1	fl-2	fl-3	fl-0	fl-1	fl-2	fl-3	fl-0	fl-1	fl-2	fl-3	fl-0	fl-1	fl-2	fl-3

fl = foot infection; H = high-risk; L = low-risk; M = moderate risk; VL = very low risk; W = wound.

Management of patients with chronic limb-threatening ischaemia

Chronic limb-threatening ischaemia (CLTI)

Pain control, risk factor management, wound care, antibiotics if needed, drainage of septic foot if needed

Patient candidate for revascularization

Urgent imaging

Revascularization feasible

Revascularization non feasible

Stenotic lesions,
short occlusions

Long occlusions

No GSV or
increased risk for
open surgery

GSV available
and patients fit
for surgery

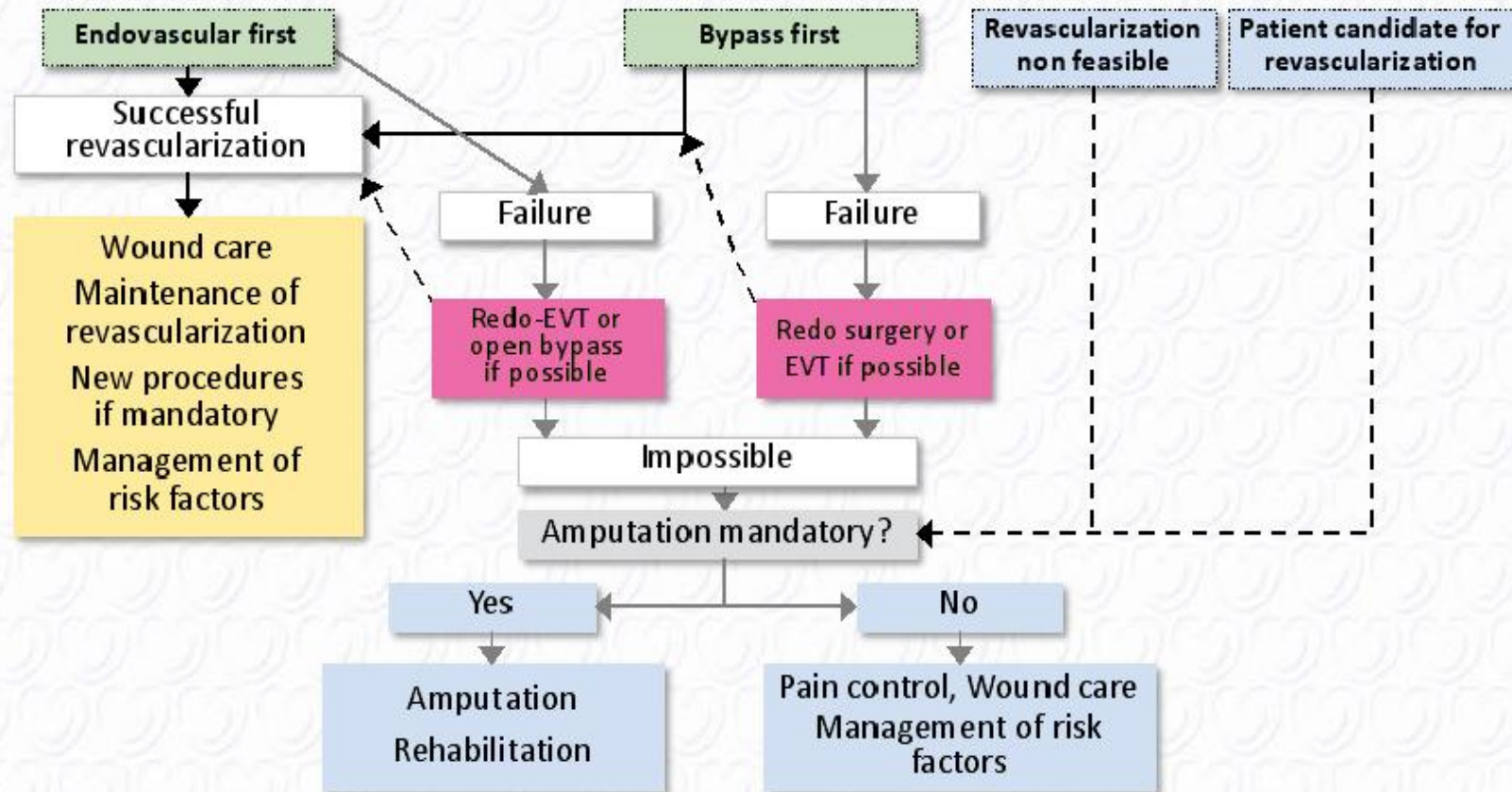
Endovascular first

Bypass first

(continued)

Management of patients with chronic limb-threatening ischaemia

(continued)



Management of Chronic Limb-Threatening Ischaemia (CLTI)

Recommendations	Class	Level
Early recognition of tissue loss and/or infection and referral to the vascular team is mandatory to improve limb salvage.	I	C
In patients with CLTI, assessment of the risk of amputation is indicated.	I	C
In patients with CLTI and diabetes, optimal glycaemic control is recommended.	I	C
For limb salvage, revascularization is indicated whenever feasible.	I	B
In CLTI patients with below-the-knee lesions, angiography including foot runoff should be considered prior to revascularization.	IIa	C
In patients with CLTI, stem cell/gene therapy is not indicated.	III	B

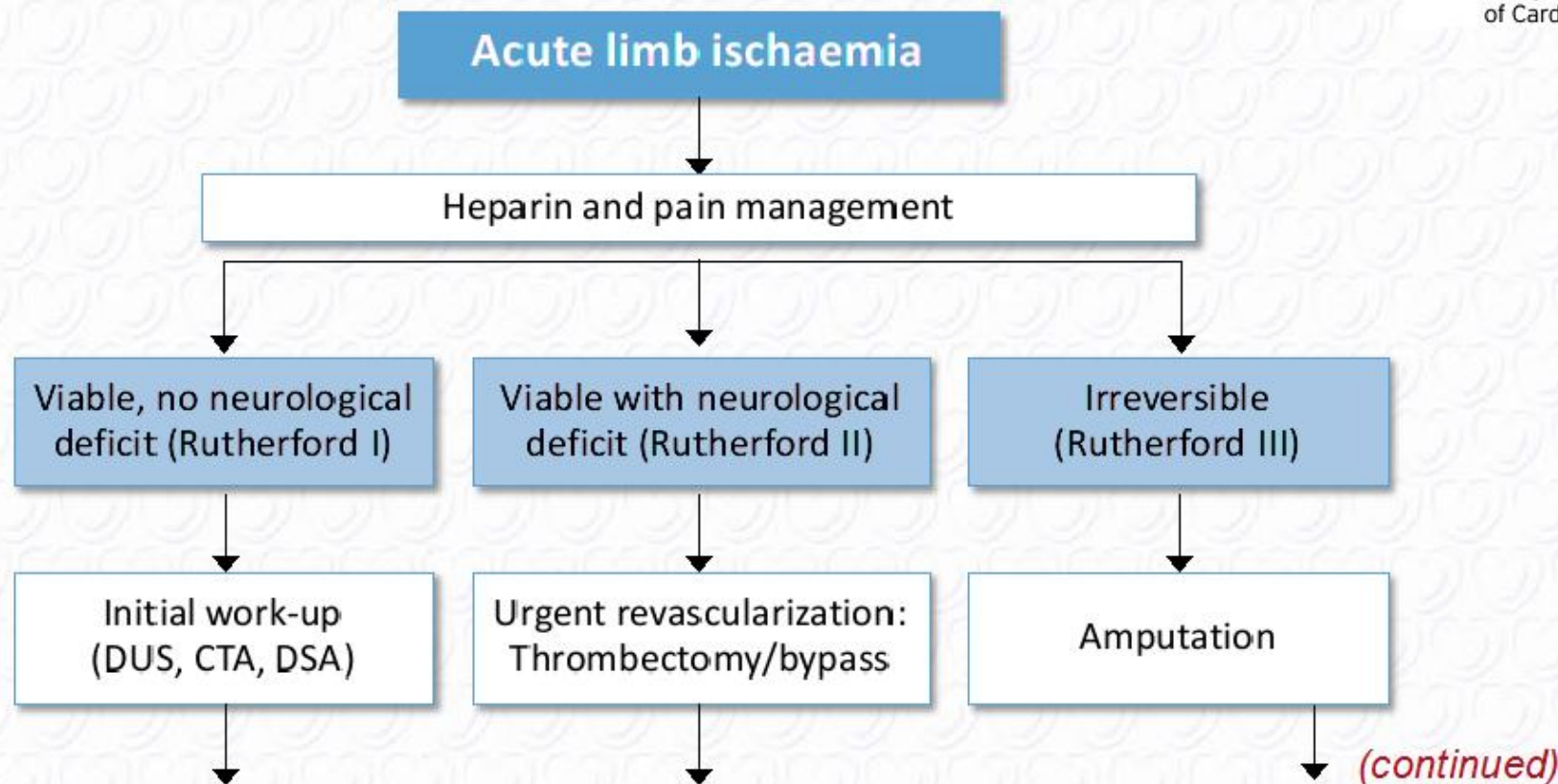
Clinical categories of acute limb ischaemia

Grade	Category	Sensory loss	Motor deficit	Prognosis
I	Viable	None	None	No immediate threat
IIa	Marginally threatened	None or minimal (toes)	None	Salvageable if promptly treated
IIb	Immediately threatened	More than toes	Mild/moderate	Salvageable if promptly revascularized
III	Irreversible	Profound, anaesthetic	Profound, Paralysis (rigor)	Major tissue loss, permanent nerve damage inevitable

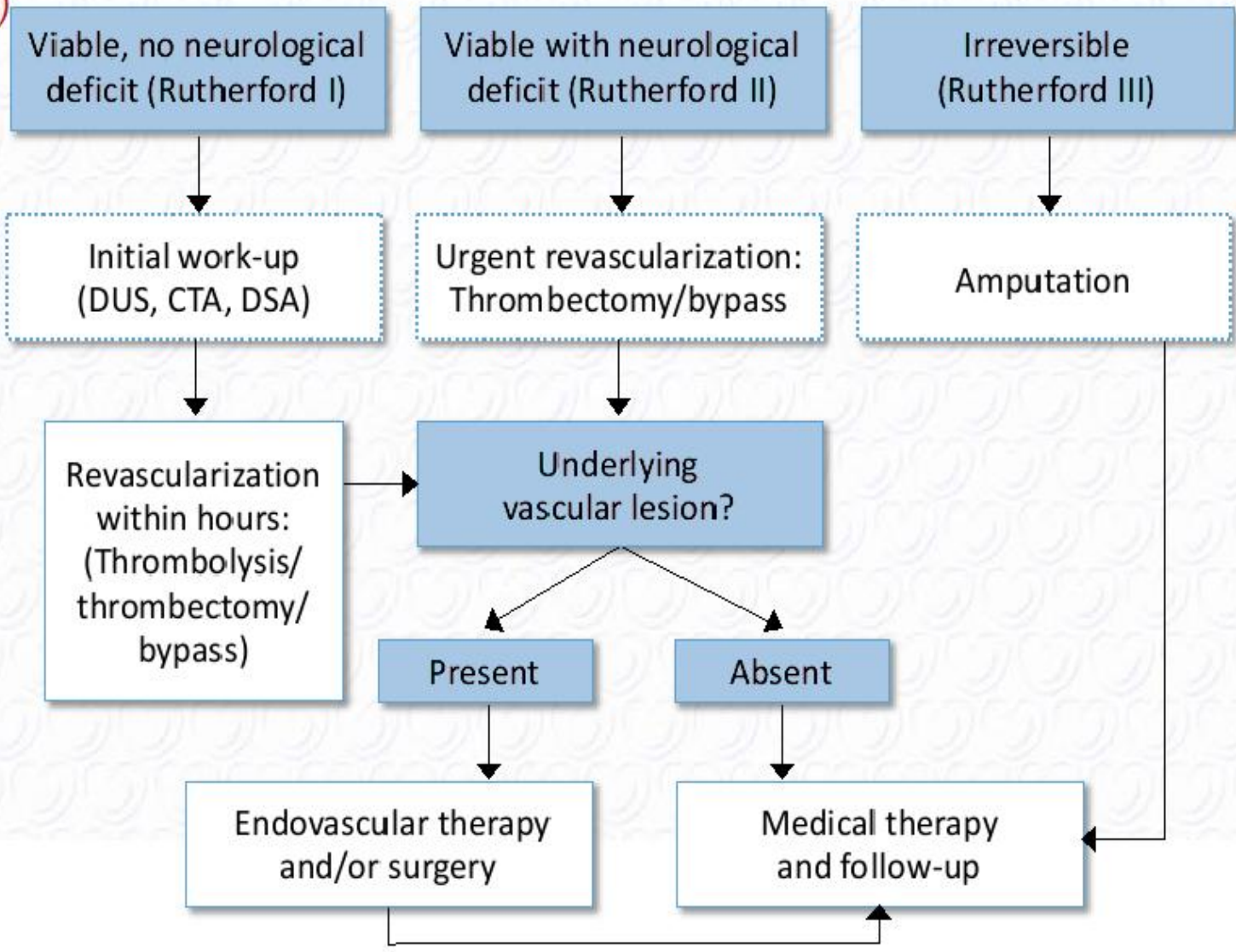
Management of patients presenting with acute limb ischaemia

Recommendations	Class	Level
In the case of neurological deficit, urgent revascularization is indicated.	I	C
In the absence of neurological deficit, revascularization is indicated within hours after initial imaging in a case to case decision.	I	C
Heparin and analgesics are indicated as soon as possible.	I	C

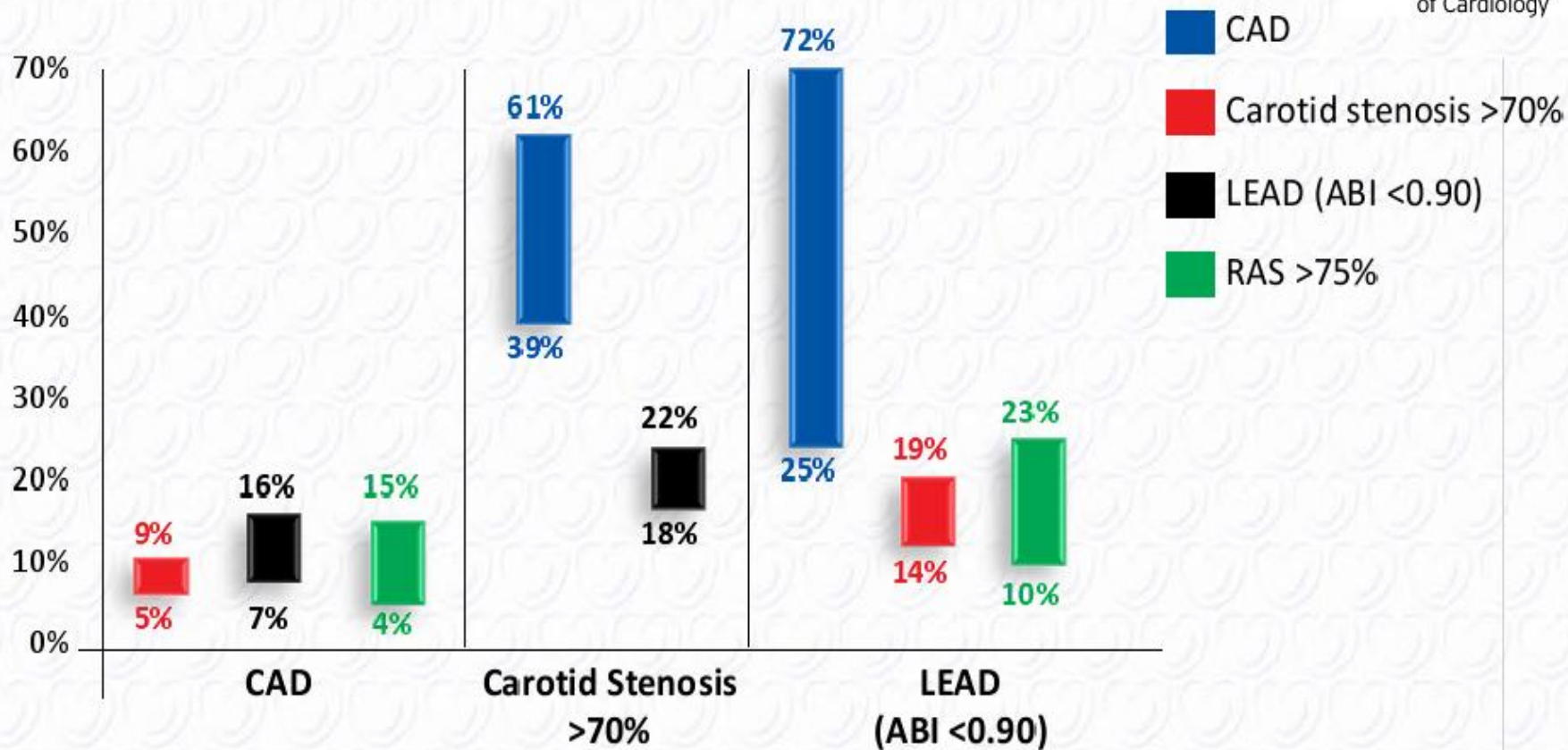
Management of acute limb ischaemia



(continued)



Reported rate ranges of other localizations of atherosclerosis in patients with a specific arterial disease



Screening of associated atherosclerotic disease in additional vascular territories

Screened disease \ Leading disease	CAD	LEAD	Carotid	Renal
CAD				
Scheduled for CABG		IIa	I / IIb	U
Not scheduled for CABG		IIb	NR	U
LEAD				
Scheduled for surgery	I		NR	U
Not scheduled for surgery	NR		NR	U
Carotid stenosis				
Scheduled for CEA/CAS	IIb	NR		U
Not scheduled for CEA/CAS	NR	NR		U

Screening for carotid disease in patients undergoing CABG

Recommendations	Class	Level
In patients undergoing CABG, DUS is recommended in patients with a recent (<6 months) history of TIA/stroke.	I	B
In patients with no recent (< 6 months) history of TIA/stroke, DUS may be considered in the following cases: age ≥ 70 years, multivessel coronary artery disease, concomitant LEAD, or carotid bruit.	IIb	B
Screening for carotid stenosis is not indicated in patients requiring urgent CABG with no recent stroke/TIA.	III	C

Management of carotid stenosis in patients undergoing CABG

Recommendations	Class	Level
It is recommended that the indication (and if so the method and timing) for carotid revascularization be individualized after discussion within a multidisciplinary team, including a neurologist.	I	C
In patients scheduled for CABG, with recent (<6 months) history of TIA/stroke:		
• Carotid revascularization should be considered in patients with 50–99% carotid stenosis,	IIa	B
• Carotid revascularization with CEA should be considered as first choice in patients with 50–99% carotid stenosis,	IIa	B
• Carotid revascularization is not recommended in patients with carotid stenosis <50%.	III	C

Management of carotid stenosis in patients undergoing CABG *(continued)*

Recommendations	Class	Level
In neurologically asymptomatic patients scheduled for CABG:		
<ul style="list-style-type: none"> • <u>Routine</u> prophylactic carotid revascularization in patients with a 70-99% carotid stenosis is <u>not</u> recommended. 	III	B
<ul style="list-style-type: none"> • Carotid revascularization may be considered in patients with bilateral 70-99% carotid stenoses or 70-99% carotid stenosis + contralateral occlusion. 	IIb	B
<ul style="list-style-type: none"> • Carotid revascularization may be considered in patients with a 70–99% carotid stenosis, in the presence of one or more characteristics that may be associated with an increased risk of ipsilateral stroke, in order to reduce stroke risk beyond the perioperative period. 	IIb	C

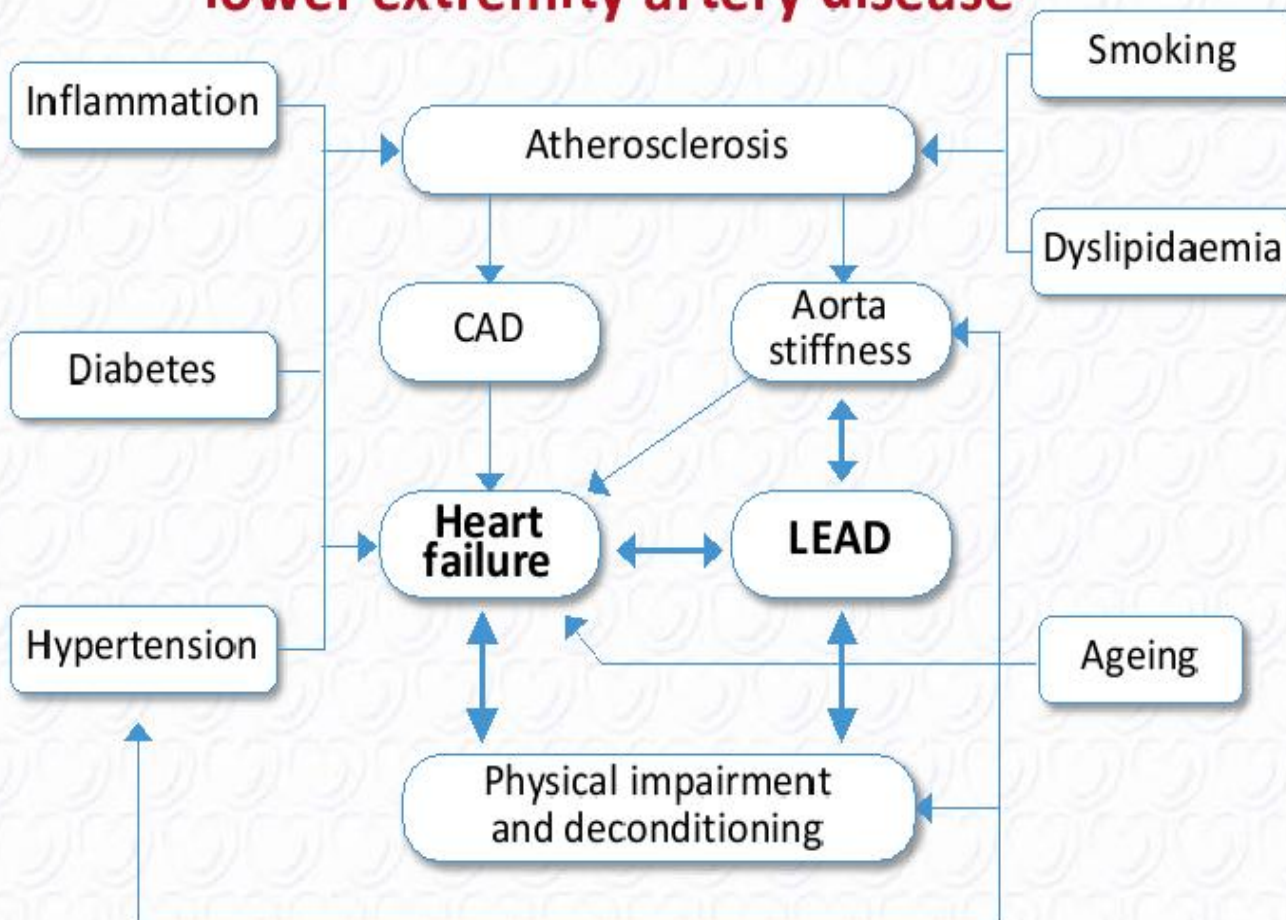
Screening and management of concomitant LEAD and CAD

Recommendations	Class	Level
In patients with LEAD, radial artery access is recommended as the first option for coronary angiography/intervention.	I	C
In patients with LEAD undergoing CABG, sparing the autologous great saphenous vein for potential future use for surgical peripheral revascularization should be considered.	IIa	C
In patients undergoing CABG and requiring saphenous vein harvesting, screening for LEAD should be considered.	IIa	C
In patients with CAD, screening for LEAD by ABI measurement may be considered for risk stratification.	IIb	B

Screening for CAD in patients with carotid artery disease

Recommendations	Class	Level
In patients undergoing elective CEA, preoperative CAD screening, including coronary angiography, may be considered.	IIb	B

Interrelations between heart failure and lower extremity artery disease



Management of HF associated with PADs

Recommendations	Class	Level
Full vascular assessment is indicated in all patients considered for heart transplantation or cardiac assist device implantation.	I	C
In patients with symptomatic PADs, screening for heart failure with TTE and/or natriuretic peptides assessment should be considered.	IIa	C
Screening for LEAD may be considered in patients with heart failure.	IIb	C
Testing for renal artery disease may be considered in patients with flash pulmonary oedema.	IIb	C

Management of AF associated with PADs

Recommendations	Class	Level
In patients with LEAD and atrial fibrillation, oral anticoagulation:		
• is recommended when CHA ₂ DS ₂ -VASc score ≥ 2 ,	I	A
• should be considered in all other patients.	IIa	B

Management of valvular heart disease associated with PADs

Recommendations	Class	Level
Screening for LEAD and UEAD is indicated in patients undergoing TAVI or other structural interventions requiring an arterial approach.	I	C


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