## GUIDELINES

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Guidelines on Peripheral Arterial Disease

CLASSIFICATION of RECOMMENDATION

Class I
Conditions for which there is evidence for and/or general agreement that a given procedure or treatment is beneficial, useful and effective.
Class II
Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

II a – weight of evidence/opinion is in favor of usefulness/efficacy
II b – Usefulness/efficacy is less well established by evidence/opinion

Class III
Conditions for which there is evidence and/or general agreement that a procedure/treatment are not useful/effective and in some cases may be harmful

Level of Evidence
A – Data derived from multiple randomized clinical trials or meta – analysis
B – Data derived from a single randomized trial or non-randomized studies
C – Only consensus of experts, case studies or standard of care

ABI Classification System

<table>
<thead>
<tr>
<th>ABI Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.3</td>
<td>incompressible</td>
</tr>
<tr>
<td>1.0 – 1.30</td>
<td>normal</td>
</tr>
<tr>
<td>0.90 – 0.99</td>
<td>equivocal/borderline</td>
</tr>
<tr>
<td>0.51 – 0.89</td>
<td>mild to moderate</td>
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Individuals at Risk for Lower Extremity PAD
- Age < 50 years with diabetes and 1 other atherosclerotic factor
- Age 50-69 years and history of smoking or diabetes
- Age older than 70 years
- Leg symptoms with exertion (suggestive of claudication) or ischemic rest pain
- Abnormal lower-extremity pulse examination
- Known atherosclerotic coronary, carotid, or renal arterial disease

Obtain history of walking impairment and/or limb ischemic symptoms
(Class 1,LOE C)
- Obtain a vascular review of symptoms:
  - Leg discomfort with exertion
  - Leg pain at rest; nonhealing wound; gangrene
No leg pain

"Atypical" leg pain

Classic claudication sxss: exertional fatigue, discomfort, or frank pain localized to leg muscle groups that consistently resolves with rest

- Ischemic leg pain at rest
- Nonhealing wound
- Gangrene

Perform a resting ABI measurement

Individual at risk of PAD (no leg symptoms or atypical leg symptoms):
Consider use of the Walking Impairment Questionnaire

Perform a resting ankle-brachial index measurement

- ABI > 1.30 (Abnormal)
- ABI 0.90 to 1.30 (borderline & normal)
- ABI < 0.90 (Abnormal)

Pulse volume recording (Class IIa LOE C)
Toe-brachial index (Class IIa LOE C)

Exercise ABI (Class IIa LOE C)
Figure 2: Diagnosis and treatment of asymptomatic peripheral arterial disease (PAD) and atypical leg pain

Classic Claudication Symptoms:
Muscle fatigue, cramping, or pain that reproducibly begins during exercise and promptly resolves with rest

Chart or document the history of walking impairment (pain-free and total walking distance) and specific lifestyle limitations

Document pulse examination (Class 1B)

<table>
<thead>
<tr>
<th>Normal results</th>
<th>Abnormal results</th>
</tr>
</thead>
<tbody>
<tr>
<td>No peripheral arterial disease</td>
<td></td>
</tr>
</tbody>
</table>

Normal post-exercise ABI: No peripheral arterial disease

Evaluate other causes of leg symptoms

Risk factor normalization:
- Immediate smoking cessation
- Treat HPN: JNC-7 guidelines (Class 1, LOE B)
- Treat lipids: NCEP ATP-III/National guidelines (Class1B, LOE B)
- Treat DM: HbA1c < 7% (Class1B, LOE B)

Pharmacological Risk Reduction:
- Anti-platelet therapy (Class 1C)
- ACE inhibition (Class IIb, LOE C)

Exercise ABI\(^2\) (TBI, segmental pressure or duplex scan exam)

<table>
<thead>
<tr>
<th>Normal results</th>
<th>Abnormal results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal post-Exercise ABI</td>
<td>Decreased post-Exercise ABI</td>
</tr>
</tbody>
</table>

Confirmed PAD Diagnosis

No PAD or consider
Figure 3: Diagnosis of claudication and systemic risk treatment

Risk factor normalization:
- Immediate smoking cessation
- Treat HPN: JNC-7 guidelines (Class 1, LOE A)
- Treat lipids: NCEP ATP III/National guidelines (Class 1, LOE B)
- Treat DM: HbA1c < 7% (Class IIa, LOE C)

Pharmacological risk reduction:
- Antiplatelet therapy (ASA) Class 1, LOE A
  (Clopidogrel) Class 1, LOE B
- ACE inhibition: Class IIa

Go to Figure 4, Treatment of Claudication

Confirmed PAD Diagnosis

- No Significant functional disability
  - No claudication treatment required
  - Follow-up visits at least annually to monitor for development of leg, coronary, or cerebrovascular ischemic symptoms
- Lifestyle – limiting symptoms
  - A. Supervised exercise program (Class 1 LOE A)
  - B. Pharmacologic therapy
- Lifestyle – limiting symptoms with Evidence of inflow
  - If pt is not amenable to A or B, may offer Home exercise program (Class II LOE B)
  - Further anatomic definition by more extensive Noninvasive or Angiographic diagnostic techniques

Refer to specialist
**Figure 1:** Steps toward the diagnosis of peripheral arterial disease (PAD). ¹“Atypical” leg pain is defined by lower extremity discomfort that is exertional, but that does not consistently resolve with rest, consistently limit exercise at a reproducible distance. ²The five “Ps” are defined by the clinical symptoms and signs that suggest potential limb jeopardy: Pain, pulselessness, pallor, paresthesias, and paralysis (WITH POLAR BEING A SIXTH “p”). ³May use a hand-held doppler for measurement.

**Figure 4: Treatment of Claudication**
Figure 2: Diagnosis and treatment of asymptomatic peripheral arterial disease (PAD) and atypical leg pain. 1Duplex scam should generally be reserved for use in symptomatic patients in whom anatomic diagnostic data are required for care but may be employed if Pulse – volume recording or toe brachial index is not available. In centers without the mentioned ancillary procedures, the clinician may just observe the patient whether he or she will be symptomatic or continues to be asymptomatic. 2If a treadmill exercise test is not available, may use a 6 minute walk test or other modalities that can be used for exercise ABI. 3Treat other risk factors, if there are any. Evaluate other causes of leg symptoms and suggest to repeat the test/tests annually. 4Other causes of leg pain may include lumbar disc disease, sciatica, radiculopathy, muscle strain, neuropathy, and compartment syndrome. 5It is not yet proven that treatment of diabetes mellitus will significantly reduce PAD-specific (limb ischemia) end points. Primary treatment of diabetes mellitus should be continued according to established guidelines. The benefit of angiotensin-converting enzyme (ACE) inhibition in individuals without claudication has not been specifically documented in prospective clinical trials but has been extrapolated from other at-risk populations. ABI indicates ankle-brachial index; HbA1C, hemoglobin A1C, Seventh Report of the Joint National Committee on Prevention, detection, Evaluation, and Treatment of High Blood Pressure; LOE, level of evidence; NCEP ATP III, National Cholesterol Education Program Adult Treatment Panel III.

Figure 3. Diagnosis of claudication and systemic risk treatment. 1Use an established walking impairment questionnaire. 2If a treadmill exercise test is not available, may employ 6-minute walk test or any other modality that can be used for exercise ABI. It is not yet proven that treatment of diabetes mellitus will significantly reduce peripheral arterial disease (PAD)-specific (limb schema) endpoints. Primary treatment of diabetes mellitus should be continued according to established guidelines. The benefit of angiotensin – converting enzyme (ACE) inhibition in individuals without claudication has not been specifically documented in prospective clinical trials, but has been extrapolated from other “at risk” populations. ABI indicates ankle-brachial index; HbA1C, hemoglobin A1C; JNC-7, Seventh Report of the evidence; NCEP ATP – III, National Cholesterol Education Program Adult Treatment Panel III.

Figure 4: Treatment of claudication. 1Supervised exercise program should be employed if available. 2Please see text. 3Please see protocol for home exercise
program. "Inflow disease should be suspected in individuals with gluteal or thigh claudication and femoral pulse diminution or bruit and should be confirmed by non-
invasive vascular laboratory diagnostic evidence of aortoiliac stenosis. Outflow disease represents femoropopliteal and infrapopliteal stenosis (the presence of occlusive lesion in the lower extremity arterial tree below the ligament from the common femoral artery to the pedal vessels). PAD indicates peripheral arterial disease.

Pharmacologic Therapy for Claudication

Class I A
1. Cilostazol (100 mg orally 2 times a day)
   Therapeutic trial of Cilostazol should be considered in all patients with lifestyle-limiting claudication (in the absence of heart failure)]

Class IIb A
1. Pentoxyfylline (400 mg 3 times a day) may be considered as a second line alternative therapy to cilostazol

With published trials showing benefit
Beraprost / Ilioprost

Drug with on-going trials
Sulodexide
Naftidofuryl
MEDICAL MANAGEMENT

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Goal</th>
<th>Intervention</th>
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<tbody>
<tr>
<td>Blood pressure</td>
<td>BP &lt;140/90 mm Hg</td>
<td>Weight control, increased physical activity, alcohol moderation, sodium reduction, medications</td>
</tr>
<tr>
<td></td>
<td>BP &lt;130/80 mm Hg with chronic kidney disease or diabetes</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Smoking cessation</td>
<td>Smoking cessation programs, nicotine replacement, bupropion, verenicline</td>
</tr>
<tr>
<td></td>
<td>Avoid environmental tobacco smoke</td>
<td></td>
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<tr>
<td>Lipid management</td>
<td>LDL-C &lt;100 mg/dl (optional goal &lt;70 mg/dl if high CAD risk)</td>
<td>Diet low in saturated fat, weight control, increased physical activity, statins, niacin, fibrates</td>
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<tr>
<td></td>
<td>Non-HDL-C ≤130 mg/dl</td>
<td></td>
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<tr>
<td>Diabetes mellitus</td>
<td>HbA1c &lt;7%</td>
<td>Diet, weight control, oral hypoglycemic agents, insulin</td>
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<tr>
<td>Physical activity</td>
<td>30 minutes, 7 days/week</td>
<td>Walking, hiking, swimming, gardening, household work</td>
</tr>
<tr>
<td></td>
<td>Minimum 5 days/week</td>
<td></td>
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<tr>
<td>Weight management</td>
<td>BMI 18.5–24.9 kg/m²</td>
<td>Physical activity, caloric intake, behavioral programs, rimonabant</td>
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<tr>
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<td>Waist circumference: ≤40 inches men; ≤35 inches women</td>
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Leg ulcer, rest pain, gangrene

Confirm ischemic etiology (noninvasive tests, differential diagnosis)

Wound care

Assess and treat coexisting disease if appropriate: cardiovascular disease, anemia, hypoxia from pulmonary disease, local infection, systemic disease, etc.
Image arterial lesions (arterial duplex scan, CT angiogram, MRA)

Leg not salvageable
(gangrene above level of forefoot amputation, does not use leg, vascular anatomy precludes successful intervention, etc)

Yes
Primary amputation

No

Anatomically favorable lesions for endovascular treatment (well delineated, short, non-calcified, symmetric iliac stenosis with good outflow)

Leg potentially salvageable

Endovascular procedure

Failed

Surveillance

If neither endovascular nor surgical revascularization is possible, or they have failed

Pharmacotherapy (also consider pharmacotherapy in shallow ischemic ulcer and rest pain particularly if high risk or anatomy unfavorable for PTA/bypass)

Failed

Amputation

Surgical bypass

Surveillance

Algorithm for Patients with Critical Limb Ischemia

DIAGNOSIS and TREATMENT for CRITICAL LIMB ISCHEMIA
Philippine Heart Center

Chronic Symptoms: Ischemic rest pain; Gangrene;
Non-healing wound
Ischemic etiology must be promptly established
Implication: Impending Limb Loss
Good History and Physical Examination
- Document lower extremity pulses

Assess factors contributing to limb risk
Diabetes Mellitus Chronic Renal

ABI, TBI, or Duplex Arterial US (Class I)

Severe lower extremity PAD documented ABI, 0.4; flat PVR wave form; Absent pedal flow

No or Minimal atherosclerotic arterial occlusive disease

Consider: Atheroembolism, Thromboembolism, or Phlegmasia Cerulea

Evaluation of source: ECG, Holter monitor, TEE and/or abdominal US, MRA, CTA, Venous Duplex

Prompt Vascular Specialist Consultation
Systematic antibiotics and wound care if with:
- Diagnostic Testing Strategy
- Skin ulceration
- Limb infection

NOT a candidate for revascularization due to co-morbidities

Medical therapy or Amputation (when necessary)

Candidate for Revascularization
- Define limb arterial anatomy
- Assess clinical and objective severity of ischemia

Revascularization NOT possible
Not fit for revascularization; Technically not possible, Lack of conduit, or Widespread infection
Imaging of relevant arterial circulation
- Non-invasive: MRA (Class I) CTA (Class IIb)
- Angiographic: DSA (Class I)

Multidisciplinary approach to control:
- Pain and/or infection
- Cardiovascular risk factors
- Co-morbidities

SURGICAL Treatment or ENDOVASCULAR

Medical Therapy

Amputation

On-going Vascular Surveillance
- Risk Factor Normalization

SURGERY for CRITICAL LIMB ISCHEMIA RECOMMENDATIONS
Class I
1. For individuals with combined inflow and outflow disease with CLI, inflow lesions should be addressed first. *(Level of Evidence: B)*
2. For individuals with combined inflow and outflow disease in whom symptoms of CLI or infection persist after inflow revascularization, an outflow revascularization procedure should be performed. *(Level of Evidence: B)*
3. Patients who have significant necrosis of the weight-bearing portions of the foot (in ambulatory patients), an incorrectable flexion contracture, paresis of the extremity, refractory ischemic rest pain, sepsis, or a very limited life expectancy due to comorbid conditions should be evaluated for primary amputation of the leg. *(Level of Evidence: C)*

OUTFLOW procedures: Infrainguinal Disease RECOMMENDATIONS
Class I
1. Bypasses to the above-knee popliteal artery should be constructed with autogenous saphenous vein when possible. *(Level of Evidence: A)*
2. Bypasses to the below-knee popliteal artery should be constructed with autogenous vein when possible. *(Level of Evidence: A)*
3. The most distal artery with continuous flow from above without a stenosis greater than 20% should be used as the point of origin for a distal bypass. *(Level of Evidence: B)*
4. The tibial or pedal artery that is capable of providing continuous and uncompromised outflow to the foot should be used as the site of distal anastomosis. *(Level of Evidence: B)*
5. Femoral-tibial artery bypasses should be constructed with autogenous vein, including
**INFLOW procedures: Aortoiliac Occlusive Disease**

**RECOMMENDATIONS**

**Class I**

1. When surgery is to be undertaken, aortobifemoral bypass is recommended for patients with symptomatic, hemodynamically significant, aorto-bi-iliac disease requiring intervention. *(Level of Evidence: A)*

2. Iliac endarterectomy, patch angioplasty, or aortoiliac or iliofemoral bypass in the setting of acceptable aortic inflow should be used for the treatment of unilateral disease or in conjunction with femoral-femoral bypass for the treatment of a patient with bilateral iliac artery occlusive disease if the patient is not a suitable candidate for aortobifemoral bypass grafting. *(Level of Evidence: B)*

3. Axillofemoral-femoral bypass is indicated for the treatment of patients with CLI who have extensive aortoiliac disease and are not candidates for other types of intervention. *(Level of Evidence: B)*

**Endovascular Treatment for Critical Limb Ischemia**

**RECOMMENDATION**

**Class I**

1. For individuals with combined inflow and outflow disease with CLI, inflow lesions should be addressed first. *(Level of Evidence: C)*

2. For individuals with combined inflow and outflow disease in whom symptoms of CLI or infection persist after inflow revascularization, an outflow revascularization procedure should be performed. *(Level of Evidence: B)*

3. If it is unclear whether hemodynamically significant inflow disease exists, intra-arterial pressure measurements across suprainguinal lesions should be performed. *(Level of Evidence: B)*

**Post-Surgical Care**

**RECOMMENDATIONS**

**Class I**

1. Unless contraindicated, all patients undergoing revascularization for CLI should be placed on anti-platelet therapy, and this treatment be continued indefinitely. *(Level of Evidence: A)*

2. Patients who have undergone placement of aortobifemoral bypass grafts should be followed up with periodic evaluations that record any return or progression of ischemic symptoms, the presence of femoral pulses, and ABIs *(Level of Evidence: B)*

3. If infection, ischemic ulcers, or gangrenous lesions persist and the ABIs is less than 0.8 after correction of inflow, an outflow procedure should be performed that bypasses all major distal stenosis and occlusions. *(Level of Evidence: A)*

4. Patients who have undergone placement of a lower extremity bypass with autogenous vein
Recommendation 36. Treatment of aortoiliac 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 [C].

- **TASC B and C lesions:** Endovascular treatment is the preferred treatment for type B lesions and surgery is preferred treatment for good-risk patients with type C lesions. The patient's co-morbidities, fully informed patient preferences, and co-morbidities must be considered.

**Type A lesions:**
- Unilateral or bilateral occlusion of CFA
- Unilateral or bilateral 1-2 cm stenosis of CIA

**Type B lesions:**
- Short (≤1 cm) stenosis of internal iliac
- Unilateral CIA occlusion
- Single or multiple stenosis (≤2 cm) involving the PFA and extending into the CIA
- Unilateral EIA occlusion not involving the origins of internal iliac or CFA

**Type C lesions:**
- Bilateral CIA occlusions
- Bilateral EIA stenoses (≤1 cm) extending into the CIA
- Unilateral CIA stenosis extending into the CIA
- Unilateral iliac-occlusive disease affecting the origins of internal iliac and/or CFA
- Moreso calcified bilateral EIA occlusions with or without involvement of origins of internal iliac and/or CFA

**Type D lesions:**
- Complete occlusion of bilateral CIA and EIA
- Complete occlusion of CFA
- Complete occlusion of infrarenal aorta

**Surgery for Critical Limb Ischemia**

**Risk Factor Normalization**
Fig. F1. TASC classification of aorto-iliac lesions. CIA – common iliac artery; EIA – external iliac artery; CFA – common femoral artery; AAA – abdominal aortic aneurysm.

**Recommendation 37. 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 [C].

- **TASC B and C lesions:** Endovascular treatment is the preferred treatment for type B lesions and surgery is preferred treatment for good-risk patients with type C lesions. The patient’s co-morbidities, fully informed patient preferences and the local

**Type A lesions**
- Single stenosis ≤10 cm in length
- Single occlusion ≤5 cm in length

**Type B lesions:**
- Multiple lesions (stenoses or occlusions), each ≤5 cm
- Single stenosis or occlusion ≤15 cm not involving the infragenicular 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
Philippine Heart Center
Department of Cardiovascular Surgery and Anesthesia
DIVISION OF VASCULAR SURGERY

Fig. F2. TASC classification femoral popliteal lesions

**CFA** – common femoral artery; **SFA** – superficial femoral artery

- Rapid or sudden decrease in limb blood flow which threatens tissue viability
- History and physical examination; determine time of onset of symptoms
- Emergent assessment of severity of ischemia:
  - Loss of pulses
  - Loss of motor and sensory function
  - Bedside handheld doppler
  - (arterial & venous signal & ABI)
- ABI, TBI, or Duplex Ultrasound
  (Vascular Lab Assessment)
Figure 5: Diagnosis of Acute Limb Ischemia

**Differentials of ALI:**
- Atheroembolism, phlegmasia cerulea dolens

**Evaluation of source:**
- ECG or holter monitor;
- TTE/TEE; and/or abdominal ultrasound, MRA
- Or CT angiography; venous duplex

**Yes**
- ABI less than 0.4, flat PVR waveform, Absent doppler signal and/or pedal flow

**No**
- Go to Treatment of Acute Limb Ischemia

**History and physical exam**

**Doppler α**
Figure E4. Algorithm for management of acute limb ischemia. Category I – Viable; Category IIA – Marginally threatened; Category IIB – Immediately threatened; Category III – Irreversible

Acute arterial thromboembolism confirmed by initial clinical examination

Start IV heparin therapy unless clinically contraindicated

Class I: Viable
- Treat as for CLI or intermittent claudication

Class IIA: Marginally threatened
- Close monitoring
- Urgent arteriography

Class IIB: Immediately threatened
- Early presentation (with some tissue loss from the forefoot and prolonged nerve dysfunction)
- Urgent thromboembolectomy

Class III: Irreversible
- Late presentation (advanced extensive tissue ischemia and necrosis)
- If not successful

Choose surgical/endovascular therapy based on location and extent of clot, type of clot (embolus or thrombus), whether native artery or bypass graft involved, patient-and intervention-related risks, contraindications to thrombolysis

If detriorates
If unsuccessful, proceed to revascularization as indicated.

- Extensive lesion
- Bypass

If delayed revascularization, fasciotomy

- In the case of embolism, identify source
- Catheter directed lytic therapy at arteriography or thromboembolectomy

If successful, identify and treat underlying lesion

- Adjunctive lytic therapy (PTA/bypass) if indicated
- Discrete lesion
- Endovascular procedure
- No lesion
- Anticoagulation therapy

Amputation after demorcation
Guidelines on Extracranial Carotid Artery Disease

Patients at risk (PAD, CAD, CVD, (+) carotid bruit) → Carotid Duplex Scan

- <50% → Best Medical Management
- 50 – 69% → Symptomatic?
  - No → Best Medical Management
  - Yes → Surgeon’s choice of additional work-up (DSA, MRA, CTA)
- ≥70% → Coronary risk stratification
Will the patient most likely benefit with intervention?
- age > 75 yrs old
- male sex
- stroke > TIA
- hemispheric > retinal
- at least 5 - year life expectancy
- less than 6% perioperative
- morbidity / mortality

Surgeon's choice of additional work-up (DSA, MRA, CTA)

- High risk?
  - CEA or CAS with DPD³
  - CAS with DPD³

Surgeon's choice of additional work-up (DSA, MRA, CTA)

- <60%
- ≥60%

Coronary risk stratification

- No
- Yes

Future slide
1 CDS can distinguish between normal and
diseased ICA with sensitivity of 96 – 98%,
specificity of 81 – 81%, accuracy of 88 – 89%.
(Zwiebel's and Strandness criteria) J Vasc Surg.
2 Antithrombotic agents: ASA (1st choice if
without contraindication. Alternatives:
Clopidogrel, Cilostazol, ASA-Dipyridamole)
Risk factor modification: hypertension,
diabetes, dyslipidemia, smoking, physical
inactivity.
3 Carotid Endarterectomy (CEA) is the 1st choice
except in high-risk patients (cardiac valvular
disease, rhythm disorders, recent MI, unstable
angina, uncontrolled BP, uncontrolled DM) or
presence of local conditions that contraindicates
CEA (postradiation therapy, restenosis, surgical
inaccessibility).
Management Protocol for Graft Surveillance

A
Intraoperative Assessment
Aryteriography or Color Duplex
Ultrasonography
(Preferred Diagnostic Method)

Abnormal
Correct Graft Abnormality

Normal

B
Pre-Discharge
Color Duplex
Scan & ABI/toe
pressure

Normal

C
Outpatient
Vascular
Laboratory
Graft Surveillance

Figure 1. In-hospital diagnostic testing algorithm following infrainguinal vein bypass grafting.

Predischarge duplex scan evaluation and study interpretation categories after infrainguinal vein bypass grafting.

- **Pre-Discharge Graft Evaluation**
  - Review Intra-operative Testing & Graft Velocity Spectra
  - Measure Limb Pressures

- **Study Interpretation**
  - Normal scan
  - Low flow graft identified
  - Graft Stenosis identified

- **Scan Proximal Graft Anastomotic Region** (B) → **Scan body of Graft** (C) → **Scan Distal Anastomotic Region** (D)

- Surveillance Threshold for Intervention:
  - SV > 300 cm/s
  - Vt > 3.5
  - ABI fall > 0.2
  - AND/OR
  - Low Graft Flow (Vp < 40 cm/s)

- Arteriography → **REPAIR DEFECT** → Return to Time 0 of surveillance protocol

- Duplex-Detected 180 cm/s < PSV < 300 cm/s → **SURVEILLANCE**
Guidelines on Abdominal Aortic Aneurysm

ABI, ankle brachial index; mo., month; PSV, peak systolic velocity; Vp, low blood flow velocity; Vr, velocity ratio
Screening for AAA in High – risk Populations

- Men aged >60 y.o. who are siblings or offspring of those with AAA (IB)
- Men aged 65-75 y.o. who have ever smoked (IIA LOEB)

- Physical examination and ultrasound of AAA (IB)
- Physical examination & One-time ultrasound for detection of AAA (IIA LOE B)
Algorithm for Asymptomatic Infrarenal AAA

Infrarenal AAA

Search for other aortic or peripheral

Medical Treatment:
- Beta blockade (IB)
- BP control, lipid lowering (IC)
- Smoking cessation (IB)

AP diameter <4 cm (UTZ)
- Bi-annual Ultrasound scan

AP diameter 4.0-5.4 cm (UTZ)
- Repeat Ultrasound q 6 to 12 months (IIA LOEB)

AP diameter ≥5.5 cm (UTZ) or Grpwh spurt (IB)
- Contrast CT or MR Scan Evaluate Anatomy

Search for other factors that may affect conduct of AAA repair: Renovascular hpn, Mesenteric ischemia, Aportoiliac occlusive disease

Low or average Risk
- Elective Open repair
- Continued CTA or MRA Surveillance q 3-6 mos

High Risk
- Endograft repair if aortic anatomy appropriate
- Continued CTA or MRA Surveillance q 3-6 mos
Algorithm for Asymptomatic Infrarenal AAA

Pararenal, Suprarenal, Type IV Thoraco-Abdominal AAA

Search for other aortic or peripheral aneurysms

Medical Treatment:
Beta blockade (IB)
BP control, lipid lowering (IC)
Smoking cessation (IB)

AP diameter <4 cm (UTZ)

Annual Ultrasound scan

AP diameter 4 – 5.4 cm

Contrast CT or MR Scan Evaluate Anatomy

Endograft repair if aortic anatomy appropriate

AP diameter 4.0 – 5.4 cm (UTZ)

AP diameter ≥5.5 cm (UTZ) or Growth spurt (IB) (See Table)

Medical Evaluation Use ACC / AHA Guidelines Perioperative evaluation for Non-cardiac surgery

Search for other factors that may affect conduct of AAA repair: Renovascular hpn, Mesenteric ischemia, Aortoiliac occlusive disease

Low or average Risk

Elective Open repair

High Risk

Continued CTA or MRA Surveillance q 3-6 mos

Urgent Open repair

Continued CTA or MRA Surveillance q 3-6 mos

Urgent Open repair

Medical Evaluation Use ACC / AHA Guidelines Perioperative evaluation for Non-cardiac surgery

AP diameter 4 – 5.4 cm
Management Algorithm for SYMPTOMATIC Infrarenal AAA

Infrarenal AAA

Medical Treatment:
- Beta blockade (IB)
- BP control, lipid lowering (IC)
- Smoking cessation (IB)

Ruptured

Symptomatic:
- Abdominal pulsatile mass with abdominal or back pain
- REPAIR indicated regardless of size

Pararenal, suprarenal or Type IV Thoracoabdominal aneurysm

High risk
(See ACC / AHA Guidelines Peri-op eval for non-cardiac Surgery)

Low or Average
(See ACC / AHA Guidelines Peri-op eval for non-cardiac Surgery)

Urgent endovascular Repair if Aortic anatomy is appropriate

Urgent open repair

RUPTURED ANEURYSM
**Pathognomonic Triad:** pulsatile abdominal mass, hypotension, abdominal/back pain (1/3 of cases)

**Rx:** no work-up needed, emergent intervention
- Acute abdominal or back pain which is generally sudden in onset, or worsening pain
- Often associated with lightheadedness or collapse

**Known AAA patient, stable**
Rx: ECG, CT scan
- ruptured: emergent intervention
- non-ruptured: evaluate for early repair

**Known AAA patient, unstable (hypotension)**
Rx: emergent intervention

**Undiagnosed AAA patient, stable**
Rx: ECG, CT Scan (UTZ)
- Non-ruptured: Evaluate for early repair
- Ruptured: Emergent intervention

**Undiagnosed AAA patient, unstable**
Rx: ECG, Resuscitate
- If stabilized: CT scan (UTZ)
- If not AAA: evaluate other causes
- Ruptured AAA: emergent intervention
- Non-ruptured AAA: evaluate for early repair
- Remains unstable: Emergent intervention
INFORMATION NEEDED from DIAGNOSTIC STUDIES

1) Length and size of the aneurysm

2) Proximal extent (infra, supra or juxtarenal)
   • supra/juxta-complex and extensive dissection
   • obligatory renal ischemia time due to clamping above the renal arteries

3) Distal extent, aneurysm or occlusive disease of the iliofemoral segments

4) Status of the suprarenal-visceral vessels (dilatation/stenosis of coeliac, mesenteric)

5) Presence of anatomical variant (horseshoe kidney, retroaortic renal vein, IVC duplication)

6) Leak or rupture

OPERATIVE MORTALITY for OPEN REPAIR

- Elective
  - 1-3 (4-6%)

- Urgent
  - 19%

- Ruptured (massive blood loss/transfusion, intraoperative MI, DIC, ARDS, renal failure, etc.)
  - 40-50%

ABDOMINAL UTZ
Most practical screening tool readily available

- Sensitivity: 87-99%; Specificity: 100%
  1) Fast and accurately defines aneurysm size within +/- 0.3cm
  2) Fairly defines proximal extent (infra, supra, juxta) – improved by DUPLEX UTZ
  3) Fairly defines status of suprarenal/visceral segments – improved by DUPLEX UTZ
  4) Distal extent poorly defined (dilatation/stenosis of iliofemoral segments)
  5) Poorly defines presence of anatomic variants (retroaortic renal veins, IVC duplication)
  6) Cannot identify leak or rupture

**COMPUTED TOMOGRAPHY**

- Provides information for iliofemoral aneurysmal extension
- Identifies leak or rupture
- Excellent modality for monitoring changes in aneurysm size

**COMPUTED TOMOGRAPHY**
Sufficient as a stand-alone modality for vital information

- Extremely accurate in diagnosis & sizing with accuracy within +/- 0.2cm
➢ Provides better definition of proximal extent of aneurysm and local anatomical relationship of the visceral & renal vessels

➢ Provides information regarding the presence of anatomical variants (horseshoe kidney, retroaortic renal vein, IVC duplication)

SPIRAL CT with 3D reconstruction

➢ Provides 3D images of aorta & its branches

➢ Better definition and roadmapping for surgical strategy

➢ May be time-consuming for urgent or emergent AAA

MAGNETIC RESONANCE ANGIOGRAPHY

1) Alternative to CT scan for preoperative evaluation in elective cases in those with incipient renal insufficiency

2) Extremely accurate for sizing

3) Correctly defines proximal and distal extent of disease in >80% of cases

4) Defines anatomical variants

5) Identifies leak or rupture

“Time-consuming, expensive, and not readily available

AORTOGRAPHY

1) Excellent in vascular roadmapping especially with suspected concomitant renal and iliofemoral stenosis.

2) Leak or rupture may be seen with extravasation of contrast medium.
3) **Underestimates aneurysm size** in the presence of non-opacified mural thrombus lining the walls.

4) Cannot identify anatomical variants.

### ESTIMATED RUPTURED RISK

<table>
<thead>
<tr>
<th>AAA Diameter (cm)</th>
<th>RUPTURE RISK (%/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>0</td>
</tr>
<tr>
<td>4 – 5</td>
<td>0.5 - 5</td>
</tr>
<tr>
<td>5 – 6</td>
<td>3 – 15</td>
</tr>
<tr>
<td>6 – 7</td>
<td>10 – 20</td>
</tr>
<tr>
<td>7 – 8</td>
<td>20 – 40</td>
</tr>
<tr>
<td>≥ 8</td>
<td>30 – 50</td>
</tr>
</tbody>
</table>

BREWSTER DC, J Vasc Surg 2003;37 (5)

- AAA diameter best predictor of rupture risk
- Rupture risk very low for <5cm (1.5%), increase substantially by 6 cm
- Current evidence 5.5 cm best threshold for repair for “average” patient

### RECOMMENDATIONS FOR UTZ SURVEILLANCE

Society for Vascular Surgery and the Society for Vascular Medicine and Biology

<3.0 cm No further testing
3.0-4.0 cm Annual US
4.0-4.5 cm US every 6 months
>4.5 cm Referral to a vascular specialist

KENT, KC Screening for AAA a consensus management. Vascular Medicine 2004; 9:87

**ANNUAL EXPANSION RATE of AAA**

<table>
<thead>
<tr>
<th>Baseline Aneurysm Size</th>
<th>Annual Expansion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4.0 cm</td>
<td>1 – 4 mm</td>
</tr>
<tr>
<td>4.0 – 6.0 cm</td>
<td>4 – 5 mm</td>
</tr>
<tr>
<td>&gt; 6 cm</td>
<td>7 – 8 mm</td>
</tr>
</tbody>
</table>

*Growth spurt* is defined by aneurysmal expansion rate greater than expected for size.

(From ACC/AHA Guidelines on Management of PAD, 2005)

**FACTORS INFLUENCING RISK of ANEURYSM RUPTURE**

<table>
<thead>
<tr>
<th></th>
<th>Low Risk</th>
<th>Average Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>&lt;5 cm</td>
<td>5-6 cm</td>
<td>&gt;6 cm</td>
</tr>
<tr>
<td>Expansion</td>
<td>&lt;0.3 cm/yr</td>
<td>0.3-0.6 cm/yr</td>
<td>&gt;0.6 cm/yr</td>
</tr>
<tr>
<td>Smoking/COPD</td>
<td>None, mild</td>
<td>Moderate</td>
<td>Severe/steroids</td>
</tr>
<tr>
<td>Family history</td>
<td>No relatives</td>
<td>One relative</td>
<td>Numerous relatives</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Normal blood pressure</td>
<td>Controlled</td>
<td>Poorly controlled</td>
</tr>
</tbody>
</table>
Shape | Fusiform | Saccular | Very eccentric
--- | --- | --- | ---

**OPERATIVE MORTALITY RISK of OPEN AAA REPAIR**

<table>
<thead>
<tr>
<th>Good Risk</th>
<th>Moderate Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;70 y/o</td>
<td>Age 70-80 y/o</td>
<td>Age &gt;80 y/o</td>
</tr>
<tr>
<td>Physically active</td>
<td>Active</td>
<td>Inactive, poor stamina</td>
</tr>
<tr>
<td>No clinically overt cardiac disease</td>
<td>Stable coronary disease; remote MI; EF &gt;35%</td>
<td>Significant coronary disease; recent MI; frequent angina; CHF; EF &lt;25%</td>
</tr>
<tr>
<td>No other significant comorbidities</td>
<td>Mild COPD</td>
<td>Limiting COPD; dyspnea at rest; O2 dependency; FEV1 &lt;1L/sec</td>
</tr>
<tr>
<td>Normal anatomy</td>
<td>Creatine 2-3</td>
<td>Creatinine &gt;3</td>
</tr>
<tr>
<td>No adverse AAA characteristics</td>
<td>Adverse anatomy or AAA characteristics</td>
<td>Liver disease (inc. PT; albumin &lt;2)</td>
</tr>
<tr>
<td>Anticipated operative mortality, 1-3%</td>
<td>Anticipated operative mortality, 3-7%</td>
<td>Anticipated operative mortality, at least 5-10%; each comorbid condition adding approximately 3-5% mortality risk</td>
</tr>
</tbody>
</table>

**MANAGEMENT OVERVIEW**

**RECOMMENDATIONS**

**Class I**
- Open repair of infrarenal AAAs and/or common iliac aneurysms is indicated in patients who are good or average surgical candidates. *(Level of Evidence: B)*

- Periodic long-term surveillance imaging should be performed to monitor for an endoleak, to document shrinkage or stability of the excluded aneurysm sac, and to determine the need for further intervention in patients who have
undergone endovascular repair of infrarenal aortic and/or iliac aneurysms.  
(Level of Evidence: B)

Class IIA

- Endovascular repair of infrarenal aortic and/or common iliac aneurysms is reasonable in patients at high risk of complications from open operations because of cardiopulmonary or other associated diseases.  
(Level of Evidence: B)

Class IIb

- Endovascular repair of infrarenal aortic and/or common iliac aneurysms may be considered in patients at low or average surgical risk.  
(Level of Evidence: B)

CURRENT RECOMMENDATIONS FOR AAA REPAIR


1) Single threshold diameter for elective AAA repair not applicable to all patients, decision for repair must be individualized in each case

2) RCTs have shown rupture risk of small (<5cm) AAA is quite low, and a policy of careful surveillance up to a diameter of 5.5cm is safe, unless rapid expansion (>1cm/yr) or symptoms develop. However, early surgery is comparable to surveillance with later surgery, so that patient preference is important, especially for AAA 4.5 to 5.5 cm in diameter.

3) Based on the best available current evidence, 5.5cm diameter appears to be an appropriate threshold for repair in an average patient.

However, subsets of younger low-risk patients, with long projected life expectancy, may prefer early repair.

If the surgeon’s personal documented operative mortality rate is low, repair may be indicated at smaller sizes (4.5-5.5 cm) if that is the patient’s preference.
4) For women, or with AAA greater than average rupture risk, elective repair at 4.5-5.0cm is an appropriate threshold for repair.

5) For high-risk patients, delay in repair until larger diameter is warranted, especially if EVAR is not possible.

6) In view of its uncertain long-term durability and effectiveness, as well as the increased surveillance burden, EVAR is most appropriate for patients at increased risk for conventional open aneurysm repair.

7) EVAR may be the preferred treatment method for older, high-risk patients, those with hostile abdomens, or other clinical circumstances likely to increase the risk of conventional open repair, if their anatomy is appropriate.

8) Use of EVAR in patients with unsuitable anatomy markedly increases the risk of adverse outcomes and the need for conversion to open repair.

9) At present there does not appear to be any justification that EVAR should change the accepted size thresholds for intervention in most patients.

10) In choosing between open repair and EVAR, patient preference is of great importance. It is essential that the patients be well informed to make such choices.
Guidelines on Thoracic Aortic Aneurysm

AORTIC DISSECTION

- Uncommon
- Potentially catastrophic disease if not recognized early and treated promptly
- Diagnosis often requires clinical suspicion
- Peak incidence is the 6th to 7th decade of life
- Has a 3:1 male preponderance

**ALGORITHM for THORACIC AORTIC ANEURYSM (TAA). Fig. 1**

**Patient with TAA**

- Medical Treatment: Beta Blockers, BP Control, Smoking cessation
- Asymptomatic
- Symptomatic* (intact)

**Ruptured (See Fig.2)**

- Aortography
- CT Angiography
Symptoms of chest, back, epigastric or flank pains, hoarseness, cough, hemoptysis, dyspnea and dysphagia; mediastinal widening, aortic knob enlargement or tracheal deviation on chest x-ray ≥5cm for patients with Marfan’s Syndrome.

Yes

Risk stratification

Low

Elective open repair

High

Urgent open

Monitor by CT Scan / MRI every 6 to 12 months

Growth spurt > 0.5 cm in 6 months

No

≥5.5 cm.**

Yes

MRI / MRA

Risk stratification

Low

High risk

Urgent endovascular repair if anatomically appropriate

**Growth spurt of >5 cm in 6 months can be associated with increased risk of aortic dissection.**
RECOMMENDATION for MEDICAL TREATMENT of PATIENTS with THORACIC AORTIC DISEASE

Class IIa

1) For patients with thoracic aortic aneurysm, it is reasonable to reduce blood pressure with beta blockers and angiotensin-converting enzyme inhibitors or angiotensin receptor blockers to the lowest point patients can tolerate without adverse effects. (LOE: B)

2) An angiotensin receptor blocker (losartan) is reasonable for patients with Marfan syndrome, to reduce the rate of aortic dilatation unless contraindicated. (LOE: B)

3) Elective aortic replacement is reasonable for patients with Marfan syndrome, other genetic diseases, or bicuspid aortic valves, when the ratio of maximal ascending or aortic root area ($r^2$) in cm$^2$ divided by the patient's height in meters exceeds 10. (LOE: C)

4) It is reasonable for patients with Loeys-Dietz syndrome or a confirmed TGFBR1 or TGFBR2 mutation to undergo aortic repair when the aortic diameter reaches 4.2 cm or greater by transesophageal echocardiogram (internal diameter) or 4.4 to 4.6 cm or greater by computed tomographic imaging and/or magnetic resonance imaging (external diameter). (LOE: C)
RECOMMENDATION for EMPLOYMENT and LIFESTYLE in PATIENTS with THORACIC AORTIC DISEASE

Class IIa

1) For patients with a current thoracic aortic aneurysm or dissection, or previously repaired aortic dissection, employment and lifestyle restrictions are reasonable, including the avoidance of strenuous lifting, pushing or straining that would require a Valsalva maneuver. (LOE: C)

Table 8. SUGGESTED FOLLOW – UP of AORTIC PATHOLOGIES AFTER REPAIR or TREATMENT

A. Pathology Interval Study

- Acute dissection Before discharge, 1 mo, 6 mo, yearly
- CT or MR, chest plus abdomen TTE
- Chronic dissection Before discharge, 1 y, 2 to 3 y
- CT or MR, chest plus abdomen TTE
- Aortic root repair Before discharge, yearly TTE
- AVR plus ascending
- Before discharge, yearly TTE
- Aortic arch Before discharge, 1 y, 2 to 3 y
- CT or MR, chest plus abdomen Thoracic aortic stent
- Before discharge, 1 mo, 2mo, 6 mo, yearly or 30 days*
- CXR, CT, chest plus abdomen
- Acute IMH/PAU Before discharge, 1 mo, 3 mo, 6 mo, yearly
- CT or MR, chest plus abdomen
- *US Food and Drug Administration stent graft studies usually required before discharge or at 30-day CT scan to detect endovascular leaks. If there is concern about a leak, a pre-discharge study is recommended; however, the risk of renal injury should be borne in mind. All patients should be receiving

- AVR indicates aortic valve replacement; CT, computed tomographic imaging; CXR, chest X-ray; IMH, intramural hematoma; MR, magnetic resonance imaging; PAU, penetrating atherosclerotic ulcer; and TTE, transthoracic echocardiography.

**RECOMMENDATIONS for SURVEILLANCE of THORACIC AORTIC DISEASE or PREVIOUSLY REPAIRED PATIENTS**

**Class Ila**

1) Computed tomographic imaging or magnetic resonance imaging of the thoracic aorta is reasonable after a Type A or B aortic dissection or after prophylactic repair of the aortic root/ascending aorta. (LOE: C)

2) Computed tomographic imaging or magnetic resonance imaging of the aorta is reasonable at 1, 3, 6, and 12 months post dissection and, if stable, annually thereafter so that any threatening enlargement can be detected in a timely fashion. (LOE: C)

3) When following patients with imaging, utilization of the same modality at the same institution is reasonable, so that similar images of matching anatomic segments can be compared side by side. (LOE: C)

4) If a thoracic aortic aneurysm is only moderate in size and remains relatively stable over time, magnetic resonance imaging instead of computed tomographic imaging is reasonable to minimize the patient’s radiation exposure. (LOE: C)

5) Surveillance imaging similar to classic aortic dissection is reasonable in patients with intramural hematoma. (LOE: C)
Class IIb

1) Adjunctive techniques to increase the tolerance of the spinal cord to impaired perfusion may be considered during open and endovascular thoracic aortic repair for patients at high risk of spinal cord injury.

2) These include distal perfusion, epidural irrigation with hypothermic solutions, high-dose systemic glucocorticoids, osmotic diuresis with mannitol, intrathecal papaverine, and cellular metabolic suppression with anesthetic agents. (LOE: B)

3) Neurophysiological monitoring of the spinal cord (somatosensory evoked potentials or motor evoked potentials) may be considered as a strategy to detect spinal cord ischemia and to guide reimplantation of intercostal arteries and/or hemodynamic optimization to prevent or treat spinal cord ischemia. (LOE: B)

RECOMMENDATIONS for SPINAL CORD PROTECTION during DESCENDING AORTIC OPEN SURGICAL and ENDOVASCULAR REPAIRS

Class I

1) Cerebrospinal fluid drainage is recommended as a spinal cord protective strategy in open and endovascular thoracic aortic repair for patients at high risk of spinal cord ischemic injury. (LOE: B)

Class IIa

1) Spinal cord perfusion pressure optimization using techniques, such as proximal aortic pressure maintenance and distal aortic perfusion, is reasonable as an integral part of the surgical, anesthetic, and perfusion strategy in open and endovascular thoracic aortic repair patients at high risk of spinal cord ischemic injury. Institutional experience is an important factor in selecting these techniques. (LOE: B)
2) Moderate systemic hypothermia is reasonable for protection of the spinal cord during open repairs of the descending thoracic aorta. (LOE: B)

PERIPROCEDURAL and PERIOPERATIVE MANAGEMENT

RECOMMENDATION for BRAIN PROTECTION DURING ASCENDING AORTIC and TRANSVERSE AORTIC ARCH SURGERY

Class I

1) A brain protection strategy to prevent stroke and preserve cognitive function should be a key element of the surgical, anesthetic, and perfusion techniques used to accomplish repairs of the ascending aorta and transverse aortic arch. (LOE: B)

Class II

1) Deep hypothermic circulatory arrest, selective antegrade brain perfusion, and retrograde brain perfusion are techniques that alone or in combination are reasonable to minimize brain injury during surgical repairs of the ascending aorta and transverse aortic arch. Institutional experience is an important factor in selecting these techniques. (LOE: B)

Class III

1) Perioperative brain hyperthermia is not recommended in repairs of the ascending aortic and transverse aortic arch as it is probably injurious to the brain. (LOE: B)
RECOMMENDATION for AORTIC ARCH and THORACIC AORTIC AHEROMA AND ATHEROEMBOLIC DISEASE

Class Ila

1) Treatment with a statin is a reasonable option for patients with aortic arch atheroma to reduce the risk of stroke. (LOE: C)

Class IIb

1) Oral anticoagulation therapy with warfarin (INR 2.0 to 3.0) or antiplatelet therapy may be considered in stroke patients with aortic arch atheroma 4.0 mm or greater to prevent recurrent stroke. (LOE: C)
Guidelines on Chronic Venous Disease

History and PE typical of CVD

Consider other causes

Apply clinical grading (CEAP)

- No venous disease (C 0)
- Telangiectasia (C 1)
- Varicose Veins (C 2)
- Edema (C 3)
- Lipodermatosclerosis or Hyperpigmentation (C 4)
- Healed Ulcer (C 5)
- Active Ulcer (C 6)

GENERAL MEASURES
Figure 1: ALGORITHM for CHRONIC VENOUS DISEASE of the LOWER EXTREMITIES

Eberhardt, et.al., Circulation, May 2005
World Congress of Microcirculation 1997
**Figure 2:** Please see text

1 – Hx and PE typical of CVD

- Leg swelling or discomfort associated with dependent position of legs, relieved by leg elevation; stasis skin changes
- Predisposing factors i.e. occupation, family hx, previous pregnancy, use of OCP, obesity

2 – Other Causes

- DVT
- Lymphedema
- Cellulitis
- Lipidema
- Systematic cause of edema

3 – CLASSIFICATION of CHRONIC VENOUS DISEASE of the LOWER EXTREMITIES
Clinical Signs (grade 0 – 6) supplemented by: (A) for asymptomatic (S) for symptomatic

Etiologic Classification
(Congenital, Primary, Secondary)

Anatomic Distribution
(Superficial, Deep or Perforator, alone or in combination)

Pathophysiologic Dysfunction
(Reflux or Obstruction, alone or in combination)

CLINICAL CLASSIFICATION of CHRONIC VENOUS DISEASE of the LOWER EXTREMITIES

- **Class 0**: No visible or palpable signs of venous disease
- **Class 1**: Telangiectasia, reticular veins, malleolar flare
- **Class 2**: Varicose veins
- **Class 3**: Edema without skin changes
- **Class 4**: Skin changes ascribed to venous disease (e.g., pigmentation, venous eczema, lipodermatosclerosis)
- **Class 5**: Skin changes as defined above with healed ulceration
- **Class 6**: Skin changes as defined above with active ulceration
TREATMENT
CHRONIC VENOUS DISEASE

General Measures
- Leg elevation
- Control of body weight
- Exercise of calf muscles
- Avoid heat
- Avoid standing for long periods
- Cold showers to delay progression of disease
- Limitation of long periods spent standing or sitting
- Periodic flexion of ankles, transfer of weight to toes
- Daily rest with legs raised (15 – 20 cm) and also at night
- Anti – stasis exercise
- Lying flat on the healthy side in the presence of unilateral varicose veins

Conservative Management
- To reduce symptoms and help prevent the development of secondary complications and the progression of disease.
- Behavioral measures such as elevating the legs to minimize edema and reducing intraabdominal pressure should be advocated.

CHRONIC VENOUS DISEASE

CLINICAL CLASSIFICATION

<table>
<thead>
<tr>
<th>GRADE I:</th>
<th>SYMPTOMS</th>
<th>SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- mild swelling</td>
<td>- ankle edema &lt; 1 cm</td>
</tr>
<tr>
<td></td>
<td>- heaviness</td>
<td>- dilated superficial veins</td>
</tr>
<tr>
<td></td>
<td>- vein dilatation</td>
<td>- normal skin and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>subcutaneous tissue</td>
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</table>

<table>
<thead>
<tr>
<th>GRADE II:</th>
<th>SYMPTOMS</th>
<th>SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- mod-severe swelling</td>
<td>- ankle edema &lt; 1 cm</td>
</tr>
<tr>
<td></td>
<td>- heaviness</td>
<td>- multiple dilated veins</td>
</tr>
</tbody>
</table>
- varicosities
- skin changes
- incompetent perforating veins (mild)
- pigmentation (mild)

GRADE III:
- severe swelling
- Calf pain
- varicosities
- + / - claudication
- ankle edema > 2 cm
- multiple dilated veins
- incompetent perforating veins
- Ulcer

4 – Conservative Management
- To reduce symptoms and help prevent the development of secondary complications and the progression of disease.
- Behavioral measures such as elevating the legs to minimize edema and reducing intraabdominal pressure should be advocated.

Other basic measures
DO:
- Wash in cold water after a shower
- Regular deep breathing exercises
- Appropriate sports: walking, swimming, cycling, running on soft ground

AVOID:
- Saunas
- Restrictive clothing, girdles
- Weight – lifting, skiing, tennis, marathons, immobile sunbathing

COMPRESSION STOCKINGS
- Mild compression
- Intermediate compression
- Strong compression
- Prevent DVT in mobile patients, 18 – 25 mm Hg
- Mild CVD, post – sclerosing therapy, 6 -34 mm Hg
○ More advance CVD, increased tendency to edema, 37 – 49 mm Hg
○ Initiate mild compression, then move to higher compression to achieve therapeutic effect
○ Must be worn after morning shower and removed last thing at night
○ Poorly tolerated in warm weather so better use during the first few hours of the day than not at all

**PHARMACOLOGIC THERAPY**

○ Four groups of drugs evaluated for CVD:
  1. Coumarins (alpha – benzopyrones)
  2. Flavonoids (gamma – benzopyrones)
  3. Saponosides (horse chestnut extracts)
  4. Other plant extracts
○ With venoactive properties, widely used in Europe but not approved for use in the USA
○ Principle for use of venoactive drugs: improve venous tone and capillary permeability
Guidelines on Deep Vein Thrombosis
Figure 1: Approach to A Patient Suspected of Acute Proximal Deep Vein Thrombosis of the Lower Extremities

Diagnostic Approach in Patients with Suspected First DVT

1 Based from the Well's Clinical Criteria. If the clinical probability is high, treatment may be started while waiting for Duplex scan result.

2 Using either SimpliRED D-dimer, Vidas D-dimer, MDA d-dimer, or Tiniquant D-dimer.

3 Includes compression, color and pulsed Doppler ultrasonography. (available at PVL). For patients who have low to intermediate clinical probability, the sensitivity and specificity of compression ultrasonography are lower. In experienced hands, sensitivity and specificity of >95% for proximal vein thrombosis. (Periph vasc dse. J. Olin 2nd ed)

A. Clinical Prediction rule for predicting pretest probability of deep vein thrombosis

Clinical Features:  
- Active cancer (treatment ongoing or within previous 6 months or palliative)  
- Paralysis, paresis or recent plaster immobilization of the lower extremities  
- Recently bedridden for more than 3 days or major surgery within 4 weeks  
- Localized tenderness along the distribution of the deep vein system  
- Entire leg swollen  
- Calf swelling by >3 cm when compared with the asymptomatic leg (measured 10 cm below the tibial tuberosity)  
- Pitting edema (greater in the symptomatic leg)  
- Collateral superficial veins (non-varicose)  
- Alternative diagnosis is likely or greater than that of deep vein thrombosis

TOTAL:  
The more symptomatic leg is used in patients with symptoms in both legs. Pretest probability calculated as the total score  
<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>&gt;3</td>
<td></td>
</tr>
<tr>
<td>MODERATE</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>&lt;0</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Wells et al. Lancet 1997; 350:1795 – 1798

D – dimer  
Using  
a. SimpliRED D – dimer  
b. Vidas D – dimer  
c. MDA D – dimer  
d. Tiniquant D – dimer

If Vidas, MDA, or Tiniquant D – dimer assays are used, patients with moderate clinical probability can be managed similarly to patients with a low clinical probability of DVT.
The sensitivity of D–dimer ELISA for acute PE was 96.4% and the negative predictive value was 99.6% (a similar strategy works for excluding DVT) Braunwald’s Heart des. 7th ed. P. 1794

The evidence for the need of anticoagulation with DVT is based on studies performed >40 years ago. This trial showed a high mortality rate in untreated patients. PE detected at autopsy was the cause of death in the majority of patients.

Subsequent uncontrolled studies confirmed that mortality was reduced when Heparin was used to treat VTE, and reported a high mortality when patients did not receive anticoagulant therapy.

Patients with DVT should be treated with anticoagulants as soon as the diagnosis is confirmed by objective testing. (Chest 126/3/Sept 2004 Suppl)

B. Consider venography if patient is unable to return for serial ultrasound or clinical probability is high.
Serial ultrasound can be done 48 to 72 hours after the initial study then 1 week after.
Guidelines on Wound Care

Chronic Ulcers / Wounds

- History, Physical Examination and Wound Assessment
  - Presence of granulation, fibrin slough, eschar;
  - Condition of skin, tendon, bone and adjacent tissues

Stasis Ulcer
- Lower 3rd leg (Gaiter area)

Ischemic Ulcer
- Distally, dorsum of Foot / toes

Neuritrophic Ulcer
- Under calluses / Pressure points, Metatarsophalangeal joint (plantar aspect)

Diabetic Foot / Ulcer
- Combination of Ischemic / Neurotrophic characteristics
Duplex Venous Scan

See Algorithm for Chronic Venous Disease with stasis ulcer

See Algorithm for Critical Limb Ischemia, Peripheral Arterial Disease

Multi – Specialty Approach to Address

Risk Factors / Co-morbidities
Control pain
Treat Infection
Treat Complications: Osteomyelitis, Neuropathies

Wound Infection / Sepsis

Present
Empiric wide spectrum anti-biotic treatment Culture and Sensitivity Tests (including anaerobic culture for Diabetic Foot)
Surgical Debridement
Amputation (when necessary)

Absent
Local Wound Care

Goals: Achieve wound healing by developing granulation tissue in a moist environment
Achieve wound closure

Methods: Hydrocolloid gel / Semi – occlusive dressing
          Calcium alginate
          Vacuum assisted closure / Negative pressure topical agents

Training Program in Vascular Surgery
Objectives: The purpose of the program is to provide learning and training environment in the field of vascular surgery for the surgical rotator:

1) to become knowledgeable in the fundamental sciences including anatomy, physiology and pathology as they relate to the diagnosis and treatment of vascular lesions

2) to be exposed in the indication, application and limitation of the available array of invasive and non-invasive diagnostic procedures and thus develop the ability and competence to interpret the results of these imaging techniques

3) be given the proper guidance in the evaluation of patient and with interaction among medical vascular and related specialties formulate a consensus of management strategy for a more comprehensive approach to patient care

4) to help in the data-base collection for purposes of registry and research into the vascular diseases
5) to be provided with suitable exposure and experience for the fellow to be proficient in the preop, intraop and post-operative treatment of vascular patients.

**First year rotation: Duration- 3 months**

- **Didactics**: Mastery of Sections 1 to 8 of the latest edition of Rutherford
- **Diagnostics**: First month: 10 days rotation each in General Radiology and in CT and MR sections
- **2 months**: Exposure to all vascular-laboratory based diagnostic procedures
- **Clinical**: To handle all admitted vascular cases and hand in hand with the vascular medical and other specialty fellows under the guidance of the Consultant staffs formulate appropriate diagnostic and therapeutic management scheme. To assist in all (elective or emergent) vascular operations categorized as either private or house case.
- **Surgical Skill**: Be able to do the following:
  a) Embolectomy
  b) Percutaneous or open dialysis access procedures
  c) Peripheral vessel exposures and anastomosis
  d) Vein harvesting, stripping and stab avulsion
  e) Minor surgical procedures at the vascular lab mini-o.r.
  f) Superficially accessible vascular trauma cases
  g) Amputations / Debridement / wound care
- **Research**: To enter relevant data of vascular patients immediately after surgery into the computer (to prevent transcription errors) for purposes of registry and research.
  a) To submit a research proposal (Clinical paper)
- **Examinations**: Written and oral will be conducted at the end of the rotation
Second year rotation: Duration- 3 months

- **Didactics:**
  a) Mastery of sections 9 to 16 of the latest edition of Rutherford.
  c) **Diagnostics:** Has developed competency in requesting and interpreting pertinent diagnostic tests

- **Clinical:** Be able to methodically present his evaluation, impression and management plan including open/endovascular approach of a prospective surgical case

- **Surgical skills:** Be able to do the following:
  a) Elective infrarenal aortic surgery, dilatation or occlusive
  b) Visceral vessel procedures
  c) Supra/infrainguinal and infrapopliteal reconstructions
  d) Abdominal vascular trauma
  e) Access complications

- **Research:**
  a) To submit a protocol for research study
  b) On-going research

- **Examination** written/oral to determine competency for the year level

Third year rotation: Duration- 3 months

- **Didactics:** Mastery of sections 17 to 22 of the latest edition of Rutherford supplemented with literature/technological/surgical technique updates found in journal publications, paper presentations and local/international conferences and workshops.

- **Diagnostics:** Has developed the confidence in performing non-invasive Duplex/Doppler studies at the vascular lab or at bedside setting.
Clinical: Be able to guide and supervise lower level co-trainees in the evaluation and treatment of vascular patients. Also to give/assign presentation every 4th Saturday of the month after M and M on basic vascular lectures or interesting, uncommon or challenging cases or innovative vascular techniques either open or endovascular or literature updates.

Surgical Skill: Be able to do the following
a) Thoraco-abdominal aortic procedures under the supervision of a consultant
b) Emergent infrarenal aortic operation
c) Endovenous laser therapy
d) Peripheral supra/infrainguinal endovascular revascularization procedures

Research: Be able to submit one retro or short term prospective research paper

Examination written and oral to determine competency for the year level and evaluation of the performance for the last 3 rotations.

### Division of Cardiovascular Surgery
Philippine Heart Center

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