RISK FACTORS FOR VASCULAR EVENTS

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DISCLOSURES

none

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65 year old Caucasian male who presents with left leg rest pain and swelling. The pain has been worsening over the past few months. He denies any skin breakdown or ulceration in his foot. He has additional history of uncontrolled diabetes type II, hypertension, and dyslipidemia. Non smoker. Presents for evaluation of his left foot rest pain.

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GOALS

1. What is arterial and venous vascular disease
2. Review of common risk factors/when to suspect vascular disease
3. Diagnostic evaluation studies of vascular disease
4. How do I apply this to my practice

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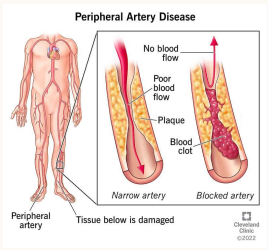
ARTERIAL DISEASE



- Plaque leads to inflammatory response causing more plaque to build up in an artery
- Narrowing or blockage of arteries by plaque or thrombus
- Narrowing →insufficient blood flow→ symptoms
- Supply demand mismatch

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RISK FACTOR CRITERIA

1. Theoretical basis
2. High Reproducibility
3. Ease of use
4. Incremental value
5. Ability to monitor and guide therapy

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COMMON RISK FACTORS

1. Age
2. Smoking
3. Hypertension
4. Dyslipidemia
5. Diabetes II
6. Race
7. Gender
8. Obesity
9. Renal disease

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ARTERIAL STIFFNESS

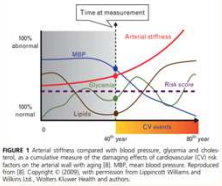

FIGURE 1 Arterial stiffness compared with blood pressure, glycemia and cholesterol, as a cumulative measure of the damaging effects of cardiovascular (CV) risk factors on the arterial wall with aging [8]. MBP, mean blood pressure. Reproduced from [8]. Copyright © (2009), with permission from Lippincott Williams and Wilkins Ltd., Wolters Kluwer Health and authors.

- What we're really talking about is arterial stiffness
- Classical risk factors contributing to increasing arterial stiffness
- It has been suggested that aortic stiffness has a better predictive value than classical risk factors
- cf-PWF considered the gold standard for measuring aortic stiffness

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CAROTID FEMORAL PULSE WAVE VELOCITY

- cfPWV – time taken for the arterial pulse to propagate from the carotid artery to the femoral artery in m/s
- Obtained by using transducer on the carotid and femoral artery

1. Theoretical basis
2. High Reproducibility
3. Ease of use
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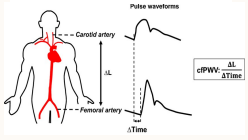
5. Ability to monitor and guide therapy

Age category (years)	Mean (±2 SD)	Median (10–90 pc)
<30	6.2 (4.7–7.6)	6.1 (5.3–7.1)
30–39	6.5 (3.8–9.2)	6.4 (5.2–8.0)
40–49	7.2 (4.6–9.8)	6.9 (5.9–8.6)
50–59	8.3 (4.5–12.1)	8.1 (6.3–10.0)
60–69	10.3 (5.5–15.0)	9.7 (7.9–13.1)
≥70	10.9 (5.3–16.3)	10.6 (8.0–14.6)

SD, standard deviation; 10 pc, the upper limit of the 10th percentile; 90 pc, the lower limit of the 90th percentile.



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SYSTEMIC CORONARY RISK EVALUATION (SCORE)

- Estimate an individual's risk for developing cardiovascular disease (CVD)
- Provides calibrated risk estimates for total CVD events for low, moderate, high, and very high populations
- Risk scores intended for use in apparently healthy persons
  - Diabetic patients, known CVD automatic high risk and not included in SCORE
  - BMI > 30 is an established risk factor
  - Resting heart rate > 90 has a 2 fold increase in risk
- SCORE uses age, sex, systolic BP, smoking, and cholesterol
  1. Theoretical basis
  2. High Reproducibility
  3. Ease of use
  4. Incremental value
  5. Ability to monitor and guide therapy

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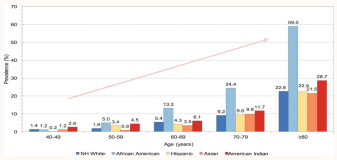
Highest risk factors
Age older than age 65
•Age 50-65 with at least one risk factor for atherosclerosis (diabetes mellitus, history of smoking, hyperlipidemia, or hypertension) or family history of PAD
•Age less than 50 with diabetes and one risk factor for atherosclerosis
•Known atherosclerosis in another vascular bed



Quick Rule of Thumb

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Management

Glycemic and BP control
1. Goal BP <130/80- ACE/ARBs
2. Goal a1c <7

Smoking cessation
1. Address at each visit
2. Pharmacotherapy plus counselling

Antiplatelet therapy
1. Aspirin 81 mg
2. Plavix 75 mg

Cholesterol
1. LDL < 70, consider < 55 in severe cases
1. Education on nutrition

Cilostazol
1. Recommended for claudication
2. Contraindicated in heart failure

Supervised exercise therapy
1. Goal to improve functional status and quality of life
2. SET-home programs
3. Offered pre and post intervention
4. Covered by insurance

Foot care
1. Inspect feet at each appointment
2. Educate of proper foot exam
3. Referral to podiatry for surveillance

Revascularization:
1. Ischemic rest pain
2. Tissue loss
3. Continued symptoms despite medical management
4. Acute limb ischemia

Gerhard-Herman M, Gornik H, Barrett C, et al. 2016 AHA/ACC Guideline on the Management of Patients With Lower Extremity Peripheral Artery Disease. *J Am Coll Cardiol.* 2017 Mar, 69 (11) e71–e126.2cTSA

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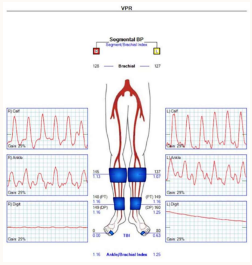
ADDITIONAL DIAGNOSTIC TESTS TO ASSESS RISK

- Ankle brachial index (ABI):
  - highly sensitive and specific for diagnosis of peripheral arterial disease
  - Ratio of ankle to brachial blood pressure with <0.9 abnormal (normal 0.9-1.3)
  - Studies show correlations of ABI less than 0.9 with increased risk for PVD, MI, renal disease, HTN, stroke
  - Always used in correlation with physical exam and 6 P's of PVD (pain, pallor, poikilothermia, pulselessness, parathesia, paralysis)
- Arterial ultrasound – non invasive for evaluation of presence and location of disease
- CTA – location of disease and surgical planning
- Conventional arteriogram – usually known disease and with intervention



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ADDITIONAL RISK ASSESSMENT MODELS FOR LIMB LOSS – RUTHERFORD FOR CHRONIC LIMB ISCHEMIA

Grade	Category	Clinical description	Objective criteria
0	0	Asymptomatic-no hemodynamically significant occlusive disease	Normal treadmill or reactive hyperemia test
	1	Mild claudication	Completes treadmill exercise; AP after exercise > 50 mmHg but at least 20 mmHg lower than resting value
I	2	Moderate claudication	Between categories 1 and 3
	3	Severe claudication	Cannot complete standard treadmill exercise, and AP after exercise < 50 mm Hg
II	4	Ischemic rest pain	Resting AP < 40 mmHg, flat or barely pulsatile ankle or metatarsal PVR; TP < 30 mm Hg
III	5	Minor tissue loss non-healing ulcer, focal gangrene with diffuse pedal ischemia	Resting AP < 60 mm Hg, ankle or metatarsal PVR flat or barely pulsatile; TP < 40 mm Hg
	6	Major tissue loss-extending above TM level, functional foot no longer salvageable	Same as category 5

AP: ankle pressure; PVR: pulse volume recording; TM: transmetatarsal; TP: toe pressure.

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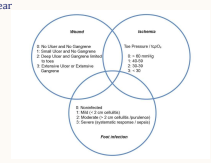
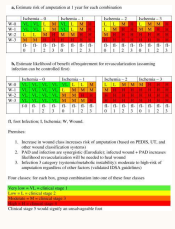
ADDITIONAL RISK ASSESSMENT MODELS FOR LIMB LOSS

- WIfI classification for wound healing and limb amputation based on three independent risk factors (wound extent, degree of ischemia, and extent of foot infection)
- predicts the risk of limb amputation at 1 year





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BACK TO OUR PATIENT…

65 year old Caucasian male who presents with left leg rest pain and swelling. The pain has been worsening over the past few months. He denies any skin breakdown or ulceration in his foot. He has additional history of uncontrolled diabetes type II, hypertension, and dyslipidemia. Non smoker. Presents for evaluation of his left foot rest pain.

65 years old, diabetic, hypertension, dyslipidemia, ABI left 0.6, right 0.99, on exam has wound over dorsal left foot, non palpable left pedal pulses

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ULCER REVIEW

- Venous ulcers – results form blood pooling
- Seldom occur below the ankle or above the knee
- Scaly skin with weepy edema and exudate
- Bluish discoloration from hemosiderin stain
- Irregular, shallow margins
- Viable tissue in the wound bed (pooling blood)

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ULCER REVIEW

- Arterial ulcer – insufficient blood flow
- Cool, pale, little exudate "barren wasteland"
- Deep, regular in shape, "punched out appearance
- Most common lateral ankle, toes, in between the toes, tips of digits

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BACK TO OUR PATIENT…

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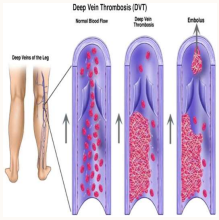
VENOUS DISEASE

- Venous thromboembolic disease (VTE)
  - Deep vein thrombosis
  - Pulmonary embolism
- Blood clots form in the veins and have the potential to become emboli
- General questions that need to be answered regarding VTE based on risk assessment
  - When do I need to anticoagulate?
  - With what and for how long?
  - Does the patient need an intervention, IVC filter, and for how long?



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RISK FACTORS FOR VTE

Cancer
Trauma
Infection
Pregnancy
Immobility
Smoking
Obesity
Hypercoaguable states
Immobility
Age
Surgery

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RISK FACTORS FOR VTE

- Challenges with risk assessment for VTE
- There is no consensus regarding a preferred VTE risk assessment tool for determination if a patient will develop VTE
- Caprini VTE risk assessment *for use in patients undergoing surgery*
  - Stratifies risk for VTE and provides validated recommendations for who should be discharged with continued prophylaxis.

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CAPRINI

Each risk factor=1 point
- Age 40–59 years
- Minor surgery planned
- BMI >25 kg/m²
- History of prior major surgery (<1 month)
- Swollen legs (current)
- Varicose veins
- Sepsis (<1 month)
- Abnormal pulmonary function (COPD)
- Acute myocardial infarction (<1 month)
- Congestive heart failure (<1 month)
- History of IBD
- Medical patient currently at bed rest

For women only (1 point each)
- Pregnant of post-partum
- History of unexplained or recurrent spontaneous abortion
- Oral contraceptives or hormone replacement therapy

Each risk factor=2 points
- Age 60–74 years
- Arthroscopic surgery
- Major open surgery (>45 minutes)
- Laparoscopic surgery (>45 minutes)
- Prior cancer (except non-melanoma skin cancer)
- Present cancer (except breast and thyroid)
- Confined to bed (>72 hours)
- Immobilizing plaster cast
- Central venous access

Caprini risk category based on total risk score

Total score	Category
0–4	Low
5–8	Moderate
≥9	High

Each risk factor=3 points
- Age ≥75 years
- History of VTE
- Family history of VTE
- Present chemotherapy
- Positive Factor V Leiden
- Positive Prothrombin 20210A
- Positive Lupus anticoagulant
- Elevated anticardiolipin antibodies
- Elevated serum homocysteine
- HIT
- Other congenital or acquired thrombophilias

Each risk factor=5 points
- Major surgery lasting >6 hours
- Stroke (<1 month)
- Elective major lower extremity arthroplasty
- Hip, pelvis, leg fracture (<1 month)
- Acute spinal cord fracture or paralysis (<1 month)
- Multiple traumas (<1 month)

Caprini Score	Risk Category	Recommended Prophylaxis	Recommended Duration of Chemoprophylaxis
0	Lowest	Early frequent ambulation only, OR At discretion of surgical team: compression boots OR low dose heparin OR low molecular weight heparin	During hospitalization
1-2	Low	Compression boots OR low dose heparin OR low molecular weight heparin (Choose 1 item)	During hospitalization
3-4	Moderate	Compression boots AND low dose heparin OR low molecular weight heparin (choose 1 medication)	During hospitalization
5-8	High	Compression boots AND low dose heparin OR low molecular weight heparin (choose 1 medication)	7-10 days total
≥9	Highest	Compression boots AND low dose heparin OR low molecular weight heparin (choose 1 medication)	30 days total

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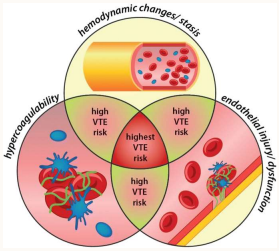
RISK FACTORS FOR VTE

- Risk assessment models for diagnosis and treatment of VTE
- Deep vein thrombosis (DVT)
  - ATTRACT trial
- Pulmonary embolism (PE)
  - Wells criteria
  - Pulmonary embolism severity index (PESI)
  - Bova
- IVC filter placement



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DVT TREATMENT RISK EVALUATION

- Diagnosis of DVT, systemic anticoagulation versus catheter directed therapy?
- Acute Venous Thrombosis: Thrombus Removal with Adjunctive Catheter-Directed Thrombolysis (ATTRACT) trial
  - multicenter randomized controlled trial that compared Pharmacomechanical catheter-directed thrombolysis (PCDT) with standard anticoagulation in 692 patients with acute DVT located above the knee.
  - 48% of patients developed PTS by 2 years, 24% of the patients developed moderate-to-severe PTS. The additional PCDT did not reduce the overall occurrence of PTS in all patients.
    - PTS defined at Vilalta score 5 or higher or ulcer development
  - PCDT did reduce the severity of PTS and provided better relief of DVT-related pain and swelling in patients randomized to PCDT
  - Further subset analysis showed a difference in PTS in patients with iliac involvement versus femoral popliteal without iliac involvement
  - major bleed in the PCDT arm 1.7% v 0.3%

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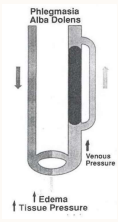
PHLEGMASIA ALBA DOLENS

- "Milk leg" or "White leg"
- Extensive venous thrombosis resulting in painful white edema
- Superficial venous system remains open



Gardella L, Faulk JB. Phlegmasia Alba And Cerulea Dolens. [Updated 2022 Oct 3]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan

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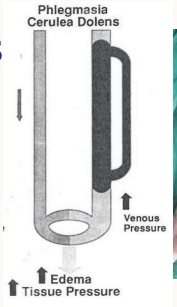
PHLEGMASIA CERULEA DOLENS

- Extensive venous thrombosis with involvement of deep and superficial system
- Significant venous congestion leading to arterial compromise
- Medical emergency



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WELLS CRITERIA RISK FOR PE

- Designed to be clinical prediction rules for diagnosing pulmonary embolism.
- Involves applying a point system to clinical variables and calculating a low, intermediate, or high clinical probability based on point total.
- If PE suspected, PE CTA is often very often ordered in today's environment

Simplified Wells Score

Variable	Points
Clinical Signs or Symptoms of Deep-Vein Thrombosis	3.0
Alternative Diagnosis Less Likely Than Pulmonary Embolism	3.0
Heart Rate >100 bpm	1.5
Immobilization or Surgery in the Previous 4 Weeks	1.5
Previous Venous Thromboembolism	1.5
Hemoptysis	1.0
Active Cancer	1.0

A total Score of ≤4.0 Indicates that PE is Unlikely, and a Score >4.0 Indicates that a PE is Likely

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PULMONARY EMBOLISM SEVERITY INDEX (PESI)

- Pulmonary Embolism Severity Index (PESI) or simplified PESI (sPESI) are models used for attempting to establish risk of death in patients with PE.
- The PESI is an assessment of 11 clinical findings that will stratify patients with PE into five classes based on increasing risk of 30 day mortality
- *Preferred over massive, submassive PE avoids confusion with anatomic burden*

Predictors	Points
Demographic Characteristics	
Age (yr)	Enter
Male Sex	+10
Comorbid Illnesses	
Cancer	+30
Heart Failure	+10
Chronic Lung Disease	+10
Clinical Findings	
Pulse ≥110/min	+20
SBP < 100 mmHg	+30
RR ≥ 30/min	+20
Temp < 36 C	+20
AMS	+60
Arterial O2 Sat <90%	+20

PESI Score

Class	Score	30 Day Mortality
I	≤65	1.6%
II	66 – 85	3.5%
III	86 – 105	8.5%
IV	106 – 125	10.4%
V	>125	24.5%

Aujesky et al. Derivation and Validation of a Prognostic Model for Pulmonary Embolism. Am J Respir Crit Care Med Vol 172 1041 - 1046 2005. PMID: 16020800

REBEL REVIEWS

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BOVA SCORE FOR PE

- The Bova score evaluates normotensive patients with acute PE to predict the development of PE related adverse events within 30 days.
- The Bova score assigns a point value to four variables and patients were assigned a stage based on point total.

Predictor	Points
SBP 90–100 mmHg	2
Elevated cardiac troponin	2
RVD (echocardiogram or CT scan)	2
Heart rate > 110 beats per min	1

Bova Score	Stage	PE-related complications*	PE-related mortality
0–2	I (Low risk)	4.4%	3.1%
3–4	II (Intermediate risk)	18%	6.8%
≥4	III (High risk)	42%	10%

*Defined as a composite including death from PE, hemodynamic collapse, or recurrent nonfatal PE. Hemodynamic collapse = systolic BP <90 mm Hg for at least 15 min or need for catecholamines, thrombolysis, endotracheal intubation, or CPR.

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IVC FILTERS

- Indications for IVC filter placement
- Active bleeding
- Immobility (with bleeding risk)
  - Surgery
  - Trauma
- Failed anticoagulation
  - Recurrent DVT while on anticoagulation

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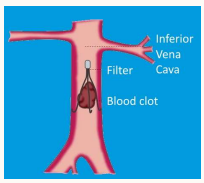
IVC FILTER REMOVAL

- IVC filters carry an increased risk of IVC thrombosis and DVT
- ***IVC filters may be removed once the risk of a clot traveling to the heart and lungs passes***
- ***I recommend evaluation for removal within 3-6 months of placement***
- Depending on clot burden, patients may be asymptomatic or go on to develop postthrombotic syndrome, debilitating lower extremity pain and edema, venous claudication, and stasis ulcers
- Recurrent PE may develop secondary to thrombus propagation above the filter or via collateral vessels bypassing the IVC filter
- renal failure secondary to propagation into the renal veins



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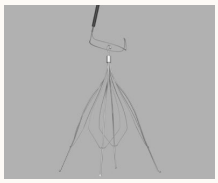
IVC FILTER REMOVAL DVT RISK

- Prevention du Risque d'Embolie Pulmonaire par Interruption Cave (PREPIC) study
  - 1 year after permanent IVCF placement 8.5% cumulative incidence of DVT .
  - 2 years, the incidence was 20.8%
  - 8 years it was 35.7%.
  - **The incidence of DVT after 2 years and after 8 years was significantly higher in the filter group compared with the nonfilter group.*



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65 years old, diabetic, hypertension, dyslipidemia, ABI left 0.6, right 0.99, on exam has wound over dorsal left foot
Ultrasound left leg negative for DVT

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THANK YOU!

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