Aortic and Peripheral Vascular Diseases

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Conflicts of Interest

• None

Vascular Disease Types

• Arterial
  Aortic
  Peripheral
    Arch/ Great Vessels and Branches
    Renal / Mesenteric
    Lower Extremities
• Venous
  IVC compression
  Deep Venous Thrombosis
  LE and UE
  Hepatic and renal
  LE Chronic Venous Insufficiency

Aortic Diseases

• Acute Syndromes: Dissection type A/B, intramural hematoma, penetrating ulcer and traumatic
• Chronic: Aneurysm from atherosclerotic disease or non atherosclerotic disease (cystic medial necrosis, vasculitis, infectious)
• Atherosclerotic embolism
• Coarctation

Practice Question #1

• 62 y.o. c/o CP / back pain, hypotensive and has new AI murmur. What is the preferred Rx?
  A) Medical Rx
  B) Emergency open surgical repair
  C) Thoracic endograft placement
  D) Pericardiocentesis

Aortic Dissection Mechanisms

Primary intimal tear  Rupture of Vasa Vasorum
Aortic Dissection Facts

- 30 cases/million/year
- 1% / hr mortality first 24 hr
- 75% mortality first 2 wks

RF for Aortic Dissection

- Hypertension
- CT Disorders (Marfans, EDS, LD and Turners)
- Bicuspid Ao Valve (50% ascending aortic pathology)
- Coarctation
- Peripartum
- Aortitis (Takayasus and Giant Cell)
- Infectious
- Iatrogenic (cath, surgery, or cocaine)
- Trauma

Ao Dissection Presentation

- Abrupt chest / back pain or migrating with possible syncope and restless
- Pulse deficits
- Hypertension or hypotension
- D Dimer elevation
- CVA
- AI, STEMI, tamponade, CVA
- Other organ ischemia (mesenteric, renal, extremities)

Complications of Aortic Dissection

- Pulmonary edema
- Pericardial effusion
- Aortic dissection
- Myocardial infarction
- Stroke
- Paraplegia
- Renal ischemia
- Lower extremity ischemia
- BVP differential, stroke

Aortic Dissection Dx

- Not all CP is ACS or PE!
- Clinical suspicion most important
- TEE / CTA / MRA / Angio
- CTA or TEE fastest

Acute Aortic Dissection Rx

- Type A (ascending): surgery
- Type B (descending): medical
  (Surgery only if complications arise)
  Endovascular Rx evolving
  BP control with βB and nupride
  Pain control
  Surveillance for aneurysm
Practice Question #2

• 45 y.o. female with Marfans with TAA and AI is followed with an annual MRA and echo. Her aortic root measures 4.8cm.
• Your recommendation is:
  A) Replace her aortic root and AV now
  B) If her AV is normal, replace only root
  C) Initiate BB in hopes to shrink TAA
  D) If BP nl, continue following with imaging

Practice Question #3

• 45 y.o. with CP and moderate AS with this CTA. What is the best next approach?
  A) Surgery for TAA
  B) Cardiac cath followed by AVR and aortic root surgery
  C) Med Rx/continued surveillance

Thoracic Aortic Aneurysms (TAA) Facts

• Presentation: most asymptomatic but can have CHF, cough, dysphagia, CP, SVC syndrome or AI
• Control BP with βB
• Timing for surgery: 5.5-7.0 cm but earlier for Marfans and bicuspid AV
• Surgical mortality 3-14% (paraplegia 5-6% Desc TAA)
• Endovascular repair evolving
• Screen 1st degree relatives if <70

Etiology of Thoracic Aortic Aneurysms

• Cystic Medial Necrosis (Marfans, BAV, EDS, Loeys-Deitz or Turners)
  • Atherosclerotic
  • Dissection
  • Vasculitis (Takayasu, Giant Cell)
  • Infectious

TAA/Marfan Syndrome Facts

• Autosomal dominant
• Prevalence 1 / 10,000
• CT disorder (FBN1 gene mutation)
• CV findings: MVP, AI, Asc Ao dilatation + dissection
• Other findings: joint hypermobility, arachnodactyly, ectopic lens / retinal detachment
**Marfan Rx**

- Long term β-blockers should be implemented
- Clinical, echo and MRA serial follow up
- Ophthalmology follow up
- Genetic and pregnancy counseling
- Ao repair when diameter > 5.0cm or 4.5cm w/ FH of dissection or pregnancy

**Practice Question #4**

66 y.o. smoker with CKD and 5.6cm AAA. What is the best strategy?

A) Medical treatment/continued followed up
B) Emergent OSR
C) Ischemic cardiac eval followed by OSR
D) Ischemic cardiac eval followed by EVAR

**Abdominal Aortic Aneurysm (AAA) Facts**

- 4.2% in male smokers 50-79 (1% females)
- Etiology usually atherosclerotic and smoking history
- Mural thrombus may embolize to lower extremities
- Usually asymptomatic until rupture
- Small risk of rupture / death until 5.5cm males and probably 5.0cm females
- Elective OSR mortality 3-4%

**AAA Physical Exam**

- Incidence increases with age
- Often has CAD
- Often has signs of PAD
- May have abdominal bruit
- May be palpable if large

**AAA Dx Testing**

- Arterial duplex sensitive and inexpensive
- CTA most accurate for anatomical details and measurements if considering EVAR
- MRA useful for patients with renal failure
AAA Screening Recommendations

- 1x for male smokers 65-75
- Presence of aneurysms elsewhere
- Not recommended for women unless aneurysm elsewhere or FH
- Surveillance with duplex / CTA q6-12 months for 4-5.4cm and q2-3yr for <4cm

AAA Evidence-Based Rx

- <5.5cm OSR not beneficial over surveillance (Adam trial)
- 30 day mortality lower with EVAR compared to OSR for >5.5cm but uncertain about long term mortality

EVAR: Endovascular Aortic repair with stent graft
Aortic Facts
- Takayasu:
  - Asian young females
  - Acute: fevers
  - Chronic: occlusive
  - Upper extremity and Ao/Pulm aneurysms
- Giant Cell:
  - Older females with PMR symptoms
  - Fevers/Occlusive arteries
  - Rx steroids

Coarctation Facts
- > 10-20mm Hg gradient between upper and lower extremity BP
- Rib notching (3-8) often seen on CXR
- Often associated with bicuspid aortic valve and intracerebral aneurysms
- Puts load on Ao and LV resulting in CHF, AI, and Ao dissection
- Mean survival 35 years left untreated

Coarctation Rx
- All patients with > 10mm Hg gradient
- Surgical repair gold standard
- Endovascular repair with PTA, bare or covered stent grafts is alternative

Practice Question #5
- 79 y.o. with ipsilateral TIAs and class III angina considered high surgical risk. What is optimal Rx?
  A) ASA / clopidogrel
  B) CEA
  C) Stenting
  D) CEA or stenting depending on MD expertise
  E) Warfarin

Carotid Artery Disease Facts
- Usually atherosclerotic
- Fibromuscular dysplasia etiology-middle age, female preference
- Thromboembolic disease mostly
- 30% of all ischemic strokes
- Stroke prevalence increases with stenosis severity

Carotid Artery Disease PE and Dx Testing
- Often has CAD and PAD findings
- May have carotid bruit
- Arterial duplex sensitive / specific and inexpensive: measures velocities
- Other imaging modalities: CTA / MRA / Conventional Angio
Carotid Artery Disease Evidence Based Rx

- Symptomatic lesions >50%: CEA better than medical Rx (NASCET Trial)
- Asymptomatic lesions >70%: CEA better than medical Rx (ACAS Trial)
- Above lesions have equal outcomes between CAS and CEA in high risk cohort (Sapphire) and low/intermediate risk (+/- Crest)

Practice Question #6

- 70 y.o. with BP discrepancy of 60mmHg and severe VBI symptoms. You should recommend?
  - A) Med Rx
  - B) Carotid to subclavian bypass
  - C) Left subclavian stent

Subclavian Artery Disease Facts

- Usually atherosclerotic
- Vertebral artery often has retrograde flow (vertebral steal) and VBI symptoms
- IMA can be compromised (IMA steal) if used as coronary graft
- Subclavian artery supplies hand which can cause hand claudication
- Thoracic Outlet: hyper-abduction induced symptoms
Subclavian Artery Disease

Disease Physical Exam
- **>20mm Hg difference in brachial syst BPs**
- Distal radial and ulnar pulses diminished
- May have bruit

Testing
- Arterial duplex sensitive and inexpensive
- MRA / CTA / Angio alternative diagnostic tests

Treatment
- PTA / stenting preferred over surgery

Other Upper Extremity Arterial Disease

- Buerger’s Disease: young smoker with finger ulcers from digital arterial PAD
- Giant Cell and Takayasu’s Arteritis
- AVF arterial disease inflow disease in hemodialysis

Practice Question # 7

- What is the optimal Rx for this 71yo with resistant hypertension on 4 meds and pulmonary edema but normal cardiac cath?

A) ACE-I and IV diuretics
B) Nitrate IV drip
C) Renal artery bypass
D) Emergency PTA/stents
E) IV diuretics/TNG/nipride for BP and pulmonary edema followed by PTA/stent

Renal Artery Disease Facts

- **Prevalence between 10-20% of patients with CAD and 30-40% with PAD**
- Etiology usually atherosclerotic but FMD common in middle aged female patients
- Causes less than 10% of hypertension in the population
- Activates renin-angiotensin system

Renal Artery Disease Facts

- Can cause pulmonary edema if bilateral stenoses
- ARF if bilateral RAS when ACEI/ARBs utilized
- Renal PTA / stenting preferred over surgery
**PE and Dx Testing**

- May have bruit and signs of PAD
- *Arterial duplex for renal size and velocities - screening test*
- MRA / CTA / angio for definitive Dx

**Renal Artery Disease Rx**

- Less then 1/3 renovascular hypertension cured and 1/3 improved with stenting
- Stenting preferred over surgery

**Renal Artery Disease: Evidence Based Rx**

- Astral and Coral RCTs showed no advantage of RAS compared to OMT but trials excluded high risk patients
- Renal denervation for refractory BP: still investigational in U.S.

**Practice Question #8**

- 78 y.o. with 4 months of post prandial pain and 20 lb. weight loss. What is your recommendation?
  - A) Medical Rx
  - B) Open Surg Bypass
  - C) Endovascular

**Mesenteric Artery Disease Facts**

- Three Vessels: Celiac, SMA, IMA
- Mostly atherosclerotic (FMD / vasculitis less likely)
- *Symptoms: post prandial abdominal pain and weight loss*
- Asymptomatic until 2 of 3 vessels diseased
- High mortality if untreated
- Patients often have CAD and PAD

**Physical Exam and Dx Testing**

- May have bruit and signs of PAD
- *Arterial duplex with elevated velocities (sensitive and inexpensive)*
- MRA / CTA / angio for definitive Dx

**Mesenteric Artery Disease Rx**

- Endovascular preferred approach over surgery
Practice Question #9

48 y.o. obese male with discolored leg pain with walking. Your initial Dx is:
A) Severe PAD
B) Spider bite with cellulitis
C) Chronic venous insuff
D) Scleroderma
E) Kaposi’s Sarcoma

Practice Question #10

72 y.o. with CAD on a statin with mild exertional calf pain. What is your recommendation?
A) ASA/cilostazol
B) Endovascular Rx
C) Fem-pop bypass

Practice Question #11

65 y.o. diabetic with CAD and CHF. What Rx would be most likely best?
A) Wound care alone
B) Amputation needed
C) HbA1C of <6 will heal this ulcer
D) Cilostazol
E) Angio/endovascular intervention

PAD Facts

• Estimated 12 million with lower extremity PAD
• Symptoms often atypical
• Same RF as with CAD (+CKD and hyperhomocystenemia)
• Prevalence higher in smokers, DM and elderly
• Can be Rx medically if claudicant without rest pain or tissue loss
• Diabetics have 8-10x increase in amputation

History

• Higher prevalence with atherosclerosis elsewhere
• Higher prevalence with smoking, DM, and age
• Symptoms: distal muscle group to disease
• Symptoms exertionally induced – claudication, but often atypical

Prevalence of PAD
Exertional Leg Pain

- **Arterial Causes**
  - Atherosclerosis
  - Irradiation
  - FMD
  - Vasculitis
  - Embolus
  - Coarctation
  - Popliteal entrapment
  - Adventitial cysts

- **Non Arterial Causes**
  - Spinal stenosis
  - Arthritis / myositis
  - Venous insufficiency

Lower Extremity PAD Examination

- Diminished or absent CFA, POPA, DP, PTA pulses
- Bruits sometimes present over groin
- Diminished or absent hair
- Tissue loss usually in digits, heel, or lateral malleolus

Dx Testing

- **ABI (ankle-brachial index)** – best screening test (EKG and stress test equivalent)
- Segmental Pressure / Volume Plethysmography
- Duplex Ultrasonography
- MRA and CTA
- Angiography

Who Should Undergo ABI Testing?

Patients with any of the following:
- Exertional leg symptoms
- Nonhealing wounds
- Age ≥65 years
- Age ≥50 with a history of smoking or DM

ACC/AHA PAD Guidelines

**Antplatelet & Antithrombotic Therapy**

- AP can reduce MI, stroke, vascular death in patients with symptomatic LE PAD
- Aspirin 75–325 mg/day is safe and effective
- Clopidogrel 75 mg/day is an effective alternative to aspirin
- Antplatelet therapy can reduce MI, stroke, vascular death in asymptomatic individuals with an ABI ≤0.90
- Warfarin is not indicated
Indications for Revascularization for PAD

• CLI: Rest pain or tissue loss
• Lifestyle limiting claudication: Failed OMT and supervised exercise program

Severe PAD Facts: Acute or Critical Limb Ischemia

• Suspect embolization from afib or bypass graft occlusion if acute
• Rest pain or tissue loss
• Requires revascularization
• Endovascular as good as surgery with fewer complications (Basil Trial)
• Critical limb ischemia has 60% three year mortality

Evidence-Based Medical Rx

• Cilostazol: yes (better than placebo and dipyridamole)
• Supervised exercise with walking: yes
• Cigarette cessation: yes
• Statin: yes
• ACE-I: yes
• ASA: yes
• Clopidogrel: better than ASA

Summary

• Type A Ao Dissection: surgery
• Type B Ao Dissection: medical with β-blockers
• AAA needs repair when 5.5cm: EVAR preferred
• Subclavian artery disease can cause VBI
• Renal artery stenting for non critical disease no different than OMT
• Medical Rx / exercise first for claudication
• Revascularization for PAD with rest pain/tissue loss

Extra Slides

• Venous Disease (not covered in lecture but important)
• Vascular Disease Pearls
• 11 Board-like questions with answers

Lower Extremity Venous Disease

• Non thrombotic proximal obstruction (pelvic masses, retroperitoneal fibrosis, May-Thurner)
• DVT / PE / Post thrombotic syndrome
• Chronic venous insufficiency (CVI)
**LE DVT/PE Prevalence**

- 400,000 new cases in U.S. annually
- 30% 30 day mortality
- RF: thrombophilia, cancer, bedrest or long trip, bone fx / surgery, CHF

**LE DVT/PE Rx**

- Iliofemoral: UFH/LMWH and warfarin or newer CAA are standard of care
- Iliofemoral: thrombolysis / mech thrombectomy if long term survival expected but needs validation
- Left Iliac vein occlusion (May-Thurner): stent
- IVC filter when contraindication to warfarin
- Look for etiology (thrombophilia, cancer)

**Upper Extremity / SVC DVT**

- 2-4% of all DVTs
- Distal swelling (facial and arm)
- SVC, subclavian and axillary veins
- Primary (Paget Schroetter-effort thrombosis)
- Secondary (catheters and malignancy)

**Rx for UE DVT**

- Thrombolysis/Stent
- Removal of catheter source
- Mechanical thrombectomy
- Surgery for thoracic outlet syndrome (1st rib removal)
- RT/chemo for cancer and endovascular

**Chronic Venous Insufficiency(CVI) Facts**

- 20% of population
- 2-6 mil in U.S. with advanced CVI and 500,000 with ulcers
- Etiology: chronic valvular incompetence or chronic DVT
- 80% of DVT pts develop CVI within 5 yrs

**CVI Facts**

- RF: DVT, obesity, trauma, pregnancy, CHF
- Symptoms diverse and include exertion induced leg pain (venous claudication)
- Appearance: swelling, varicose veins, hyperpigmentation, lipodermatosclerosis
- Ulcers in gaiter area are end stage
CVI Rx
- Diuresis and antibiotics if needed
- **Elevation and compression therapy**
- Support hose and exercise
- Iliac artery stenting
- Ablation if above fails
- Skin care and grafting for ulcers

Vascular Pearls
- Malignant hypertension on >3 drugs with diuretic-r/o renovascular hypertension
- PAD with PP abd pain-r/o mesenteric ischemia
- TIA with nl head MRI-r/o carotid artery disease
- Hand claudication with VBI-r/o subclavian stenosis
- CP with AI murmur-r/o type A aortic dissection
- Smoker/Diabetic with LE symptoms-r/o PAD

Vascular Pearls
- Elevation pallor and dependent rubor-r/o PAD
- Telangiectasias-r/o CTD
- Acute livedo-r/o embolism from aneurysm
- Acute ischemic leg pain with a fib-r/o embolism
- Toe/heal ulcers and absent hair-r/o severe PAD
- Ulcers in gaiter area with dark pigmented skin-r/o CVI
- Splinter nailbed hemorrhages-r/o endocarditis
- Finger ulcers/diminished pulses-r/o Buerger’s

Vascular History Pearls
Claudication
- Consistent distance
- Relief with standing
- Symptoms foot/calf to proximal usually
- Hard or cramping

Pseudo-claudication (spinal stenosis)
- Variable distance
- Relief with sitting, leaning, for bending
- Symptoms back, hip, high moving down
- Numb or burning

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  C) Ischemic cardiac eval followed by OSR.
  D) Ischemic cardiac eval then EVAR.

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