

WESTERN VASCULAR SURGERY STUDENT HANDBOOK

(2013 Ed.)

TABLE OF CONTENTS

1. Welcome
2. Rotation Objectives
3. Rotation Expectations
 - a. Morning patient rounds
 - b. Morning teaching rounds
 - c. OR
 - i. Radiation safety
 - d. Clinic
4. Palpable pulses
5. Arterial Anatomy
6. Selected Topics
 - a. AAA
 - b. TAA/TAAA
 - c. Aneurysm Rupture
 - d. Claudication
 - e. Acute Limb Ischemia
 - f. Critical Limb Ischemia
 - g. Mesenteric Ischemia
 - h. Carotid Disease
 - i. Risk Reduction
 - j. Thrombolytics
 - k. Anti-thrombotics
7. Post-Operative Orders

Welcome to your vascular surgery rotation!

The vascular surgery department is based out of Victoria hospital, where our out patient clinics, inpatient ward and operating rooms reside. Currently, there are four staff surgeons, two vascular surgery fellows and a number of vascular surgery residents on service at any given time.

The Division of Vascular Surgery is dedicated to excellence and leadership inpatient care, education and research. The clinical program is located at Victoria Hospital where we provide vascular surgery care to the citizens of Southwestern Ontario and beyond, with a catchment area of 1.9M. Over 800 major surgical procedures are performed yearly by our surgeons, including over 330 aortic aneurysm repairs, half of which are treated endovascularly. With close collaboration with our interventional radiology and vascular medicine colleagues, we provide complete patient care including risk reduction, medical management, percutaneous interventions, endovascular and open surgical procedures.

Disclaimer: This manual was designed as an introduction to your vascular surgery rotation, and to be used as a supplemental learning tool. It is not intended as a substitute for physician discretion and clinical judgment.

EXPECTATIONS:

Morning Patient Rounds: We are a very busy service. Mornings begin with inpatient rounds, where we will see all of our inpatients, usually around 25-30. It is expected that all patients are seen by a physician and have a progress note written in SOAP format. With such a high volume of inpatients, it is important to work efficiently. Coming in early to review recent lab values, and chart vital signs can be very helpful.

Medical students and junior residents are responsible for:

1. Having inpatient lists printed for all team members
2. Being up to date on recent lab values and vital signs
3. Charting progress notes
4. Undressing and debriding wounds

Morning Teaching Rounds:

Tuesday (0700 – 0800): Endovascular Case of the Week – Library E2

Wednesday (0700 – 0800): Vascular/IR rounds – McLaughlin Room E2

Wednesday (0800 – 0900): Vascular resident teaching – McLaughlin Room E2

Operating Room:

There is at least one vascular OR per day, and at times two cases may be happening simultaneously. It is important to familiarize yourself with the patient's history prior to the OR as this will facilitate learning and understanding of the procedures. It is also important to introduce yourself to the nursing staff in the operating room.

Radiation Safety

We often use fluoroscopy for endovascular procedures. Radiation safety is very important, and you must wear a leaded apron and thyroid protector for the entirety of the case. These can be found in the central core. Make sure you pick a set that fits properly. Lead is not worn outside of the operating room and you must return it to its place when finished. It is important to avoid creasing the leaded aprons and thyroid protectors as this significantly impairs the ability of the lead to protect the wearer from radiation.

Clinic:

These are also run daily, and can be found in E2. The duties of the medical students and junior residents include:

1. Familiarizing yourself with the patient's previous history and reason for assessment
2. Taking a thorough history and physical exam
3. Reviewing recent imaging studies
4. Discussing case with staff member

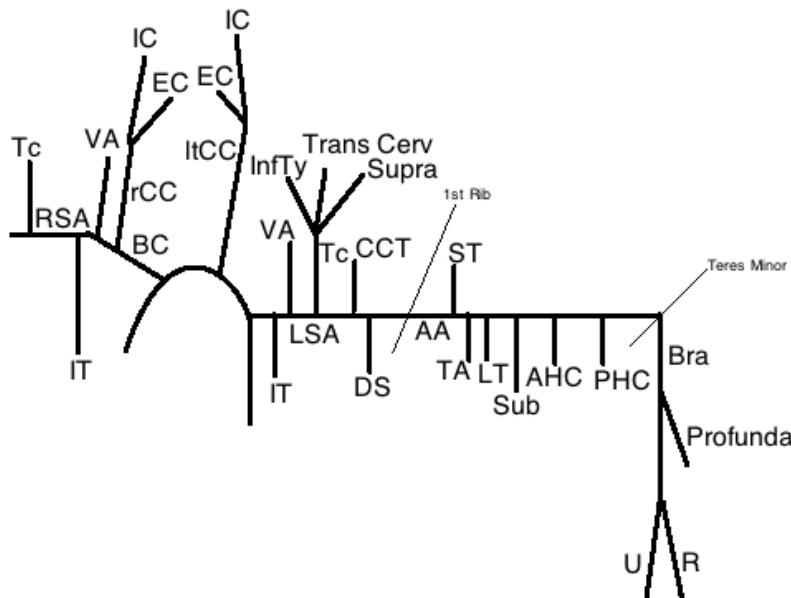
A staff vascular surgeon must evaluate all patients unless otherwise specified.

PALPABLE PULSES:

A pulse examination should be performed in a relatively consistent manner and should always be complete. Comment if the pulse is present, decreased or absent. Examining the contralateral extremity can demonstrate changes that could indicate proximal stenosis or occlusion.

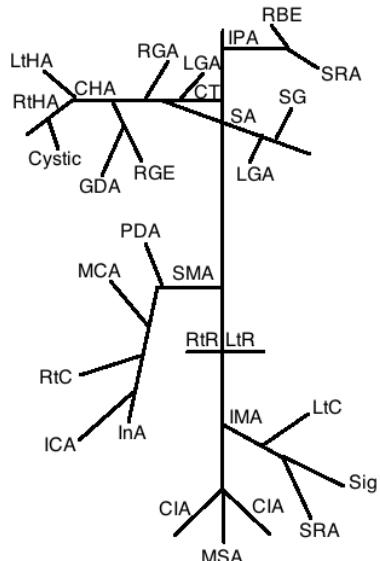
1. Radial: Lateral wrist. Best felt with light palpation.
2. Ulnar: Medial wrist. Requires firmer palpation due to its deeper course compared to the radial artery
3. Brachial: Antecubital fossa
4. Carotid: Midneck region anterior to sternocleidomastoid muscle
5. Femoral: Located at midpoint (or slightly medial) of the inguinal ligament, which runs from the ASIS to pubis.
6. Popliteal: Lateral to popliteal fossa, between the two heads of the gastrocnemius. Best felt with patient sitting with a relaxed leg dangling over the edge of the bed. Firm palpation is required to feel this pulse.
7. Dorsalis Pedis: Found on the dorsum of the foot between the first and second metatarsal bones.
8. Posterior Tibial: Found in the hollow posterior to medial malleolus.

ARTERIAL ANATOMY: UPPER EXTREMITY



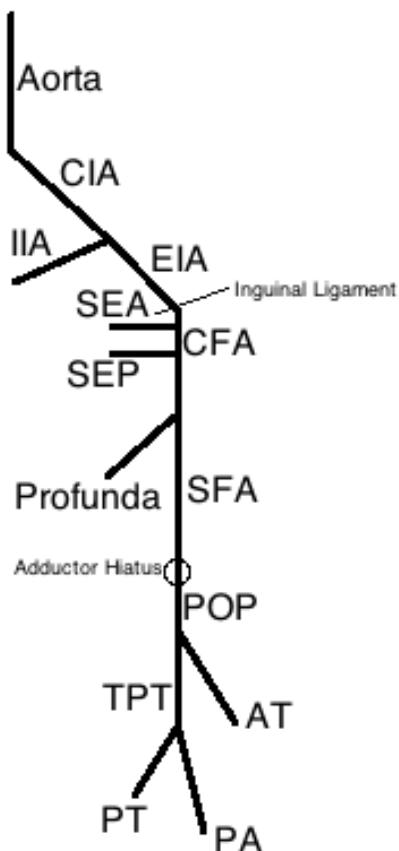
| | | | |
|-------|------------------------------|------------|-------------------------|
| AHC | Anterior Humeral Circumflex | Profunda | Profunda Brachial |
| BC | Brachiocephalic | R | Radial |
| Bra | Brachial | rCC | Right Common Carotid |
| CCT | Costocervical | RSA | Right Subclavian Artery |
| DS | Dorsal Scapular | ST | Superior Thoracic |
| EC | External Carotid | Sub | Subscapular |
| IC | Internal Carotid | Supra | Suprascapular |
| InfTy | Inferior Thyroid | TA | Thoraco-acromial |
| IT | Internal Thoracic | Tc | Thyrocervical |
| LT | Lateral Thoracic | Trans Cerv | Transverse Cervical |
| ltCC | Left Common Carotid | U | Ulnar |
| PHC | Posterior Humeral Circumflex | VA | Vertebral Artery |

ARTERIAL ANATOMY: ABDOMINAL



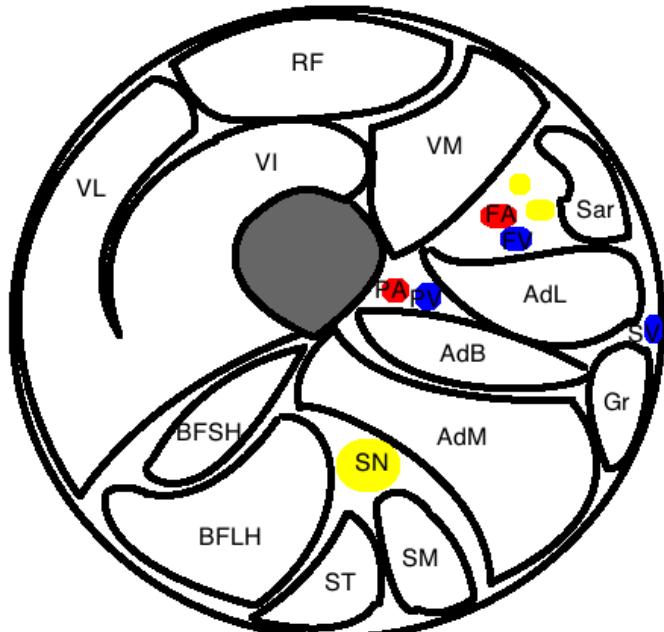
| | | | |
|--------|----------------------------|------|----------------------------|
| CHA | Common Hepatic Artery | MSA | Median Sacral Artery |
| CIA | Common Iliac Artery | PDA | Pancreaticoduodenal Artery |
| CT | Celiac Trunk | RBE | Recurrent Branch Esophagus |
| Cystic | Cystic Artery | RGA | Right Gastric Artery |
| GDA | Gastroduodenal Artery | RGE | Right Gastroepiploic |
| ICA | Ileocolic Artery | RtC | Right Colic |
| IMA | Inferior Mesenteric Artery | RtHA | Right Hepatic Artery |
| InA | Interstinal Arteries | RtR | Right Renal |
| IPA | Inferior Phrenic | SA | Splenic Artery |
| LGA | Left Gastric Artery | SG | Short Gastrics |
| LtC | Left Colic | Sig | Sigmoid Artery |
| LtHA | Left Hepatic Artery | SMA | Superior Mesenteric Artery |
| LtR | Left Renal | SRA | Suprarenal |
| MCA | Middle Colic Artery | SRA | Superior Rectal Artery |

ARTERIAL ANATOMY: LOWER EXTREMITY



| | | | |
|-----|-----------------------|----------|-------------------------------|
| AT | Anterior Tibial | Profunda | Profunda Femoris |
| CFA | Common Femoral Artery | PT | Posterior Tibial |
| CIA | Common Iliac Artery | SEA | Superficial Epigastric Artery |
| EIA | External Iliac Artery | SEP | Superficial External Pudendal |
| IIA | Internal Iliac Artery | SFA | Superficial Femoral Artery |
| PA | Peroneal Artery | TPT | Tibial Peroneal Trunk |
| POP | Popliteal | | |

ARTERIAL ANATOMY: THIGH COMPARTMENTS



Anterior Compartment Thigh

| | |
|-----|--------------------|
| Sar | Sartorius |
| RF | Rectus Femoris |
| VL | Vastus Lateralis |
| VI | Vastus Intermedius |
| VM | Vastus Medius |
| FA | Femoral Artery |
| FV | Femoral Vein |

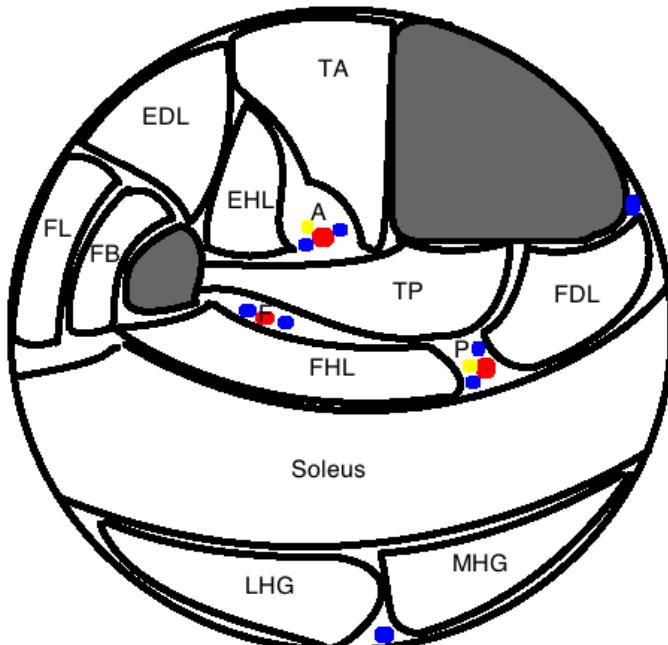
Posterior Compartment Thigh

| | |
|----|-----------------|
| BF | Biceps Femoris |
| ST | Semitendinosus |
| SM | Semimembranosus |
| Sc | Sciatic Nerve |

Medial Compartment Thigh

| | |
|----|-----------------|
| Gr | Gracilis |
| AL | Adductor Longus |
| AB | Adductor Brevis |
| AM | Adductor Magnus |

ARTERIAL ANATOMY: LOWER LEG COMPARTMENTS



Anterior Compartment

| | |
|------------------------------|-----------------------------|
| TA | Tibialis Anterior |
| EHL | Extensor Hallicus Longus |
| EDL | Extensor Digitorum Longus |
| A | Anterior Tibial Artery/Vein |
| Peroneus Tertius (not shown) | |

Deep Posterior Compartment

| | |
|-----------------------|------------------------------|
| TP | Tibialis Posterior |
| FHL | Flexor Hallicus Longus |
| FDL | Flexor Digitorum Longus |
| P | Posterior Tibial Artery/Vein |
| Popliteus (not shown) | |

Lateral Compartment

| | |
|----|------------------|
| FL | Fibularis Longus |
| FB | Fibularis Brevis |

Superficial Posterior Compartment

| | |
|--------|----------------------------|
| Soleus | Soleus |
| LHG | Lateral Head Gastrocnemius |
| MHG | Medial Head Gastrocnemius |

ANATOMY MNEUMONICS

Branches of External Carotid Artery: Some Attending Physicians Like Freaking Out Potential Medical Students (*Superior thyroid, Ascending Pharyngeal, Lingual, Facial, Occipital, Posterior auricular, Maxillary, Superficial Temporal*)

Branches of Subclavian Artery: Very Tired Individuals Sip Strong Coffee Served Daily (*Vertebral, Throcervical trunk (Inferior thyroid, superficial cervical, suprascapular), Costocervical (Superior intercostal, Deep cervical)*)

Branches of Axillary Artery: Screw The Lawyers Save A Patient (*Superior thoracic, Thoracoacromial, Lateral thoracic, Subscapular, Anterior circumflex humeral, Posterior circumflex humeral*)

Branches of Internal Iliac Artery: I Love Going Places In My Very Own Underwear (*Ileolumbar, Lateral Sacral, Gluteal (superior and inferior), Pudendal (internal), Inferior vesicle (uterine in females), Middle Rectal, Vaginal, Obturator, Umbilical*)

Branches of Profunda Femoris: Put My Leg Down Please (*Profunda femoris, Medial circumflex, Lateral circumflex, Descending genicular, Perforating arteries*)

SELECTED TOPICS: ANEURYSMS

Aneurysms: Dilation of an artery 1.5 times its original size

True aneurysm: involves all 3 layers of the arterial wall

False aneurysm: presence of blood flow outside the normal layers of the arterial wall (pseudoaneurysm)

1. AAA

a. Def'n

- i. Dilation of the abdominal aorta to 1.5 times its size (usually 3cm or greater in diameter)

b. Types

- i. Infrarenal: Aneurysmal below renal arteries
- ii. Suprarenal: Extension of aneurysm above renal arteries
- iii. Juxtarenal: Do not involve renal arteries; however, open surgical repair would require clamping above the renal arteries

c. Etiology/Risk factors

| Risk Factor | Odds Ratio |
|---------------------------------|------------|
| Smoking History | 5.1 |
| Family History | 1.9 |
| Older age (per 7 year interval) | 1.7 |
| Coronary Artery Disease | 1.5 |
| Hypercholesterolemia | 1.4 |
| COPD | 1.2 |

d. Symptoms

- i. Majority of AAAs are asymptomatic
- ii. Rarely size will cause compression:
 1. Duodenum (early satiety, N/V)
 2. Ureters (hydronephrosis)
 3. Iliocaval compression (thrombosis)
 4. Vertebral compression (back pain)
 5. Peripheral embolic symptoms (as thrombus or atherosclerotic disease breaks from aneurysm sac and travels peripherally)

e. Physical Examination

- i. Pulsatile abdominal mass
- ii. Peripheral pulses may yield peripheral aneurysms (particularly popliteal)

f. Imaging

- i. U/S:
 1. Pros: least expensive and least invasive. Should measure diameter in the anterior-posterior dimension for highest accuracy
 2. Cons: Cannot accurately detect rupture, and often not the upper extent of AAA. May be difficult to visualize due to bowel gas or in obese patients.
- ii. CTA:
 1. Pros: accurate dimensions of aneurysm, and detection of rupture. Used to evaluate patients for potential endovascular repair.
 2. Cons: Patients are exposed to radiation and contrast dye. CT scanner can be a dangerous place for unstable patients.

iii. Screening:

1. Recommendations are to screen all males above the age of 65 that have ever smoked (defined as 100 lifetime cigarettes), with an abdominal ultrasound. OR if a first-degree relative is diagnosed with AAA.

g. Risk of rupture

i. Diameter:

| AAA Diameter (cm) | Rupture Risk (%/yr) |
|-------------------|---------------------|
| <4 | 0 |
| 4-5 | 0.5 – 5 |
| 5-6 | 3 – 15 |
| 6-7 | 10 – 20 |
| 7-8 | 20 – 40 |
| >8 | 30 – 50 |

*J Vasc Surg. 2003; 37:1106-1117

- ii. Systemic factors: HTN, current smoking, COPD and female gender are independent risk factors for rupture

h. Medical Management: focuses on reducing concomitant cardiovascular risk

- i. Smoking cessation
- ii. HTN management (Beta-blockers, ACE-inhibitors)
- iii. Cholesterol reduction (statins, diet)
- iv. Exercise therapy

- i. Surgical Management: focuses on preventing rupture. The decision for surgical repair is multi-factorial and weighs the risks and benefits of surgery carefully. Generally a diameter > 5.5cm indicates the risk of rupture is greater than the risks associated with surgical repair.
 - i. Endovascular Repair: for those with appropriate anatomy as determined by CT imaging, a bifurcated tube graft is inserted within the aorta to exclude the aneurysm sac from systemic circulation.
 - ii. Open Repair: for those unfavorable to endovascular repair. Often through an abdominal incision the retroperitoneal aortic aneurysm is exposed, excluded from circulation by proximal and distal vascular clamps, and the aortic sac is opened and replaced by a synthetic tube graft.

SLECTED TOPICS: ANEURYSMS

2. TAA/TAAA

- a. Def'n: Diameter larger than 150% normal
- b. Crawford classification:
 - i. Type 1: Distal left subclavian above renal arteries
 - ii. Type 2: Distal left subclavian beyond renal arteries
 - iii. Type 3: Distal 6th rib beyond renal arteries
 - iv. Type 4: Distal 12th rib to iliacs
 - v. Type 5: Distal 6th rib above renal arteries
- c. Symptoms:
 - i. Majority are asymptomatic
 - ii. 20-30% will have associated AAA
- d. Imaging:
 - i. Generation of sagital, coronal, oblique, and 3-D reconstructions
 - ii. Allows visualization of disease in branch vessels
- e. Risk of rupture: is difficult to determine, but very high mortality with rupture, generally candidate for repair at 6cm diameter
- f. Endovascular Repair: At times a preferred option with lower morbidity and mortality, however, a number of factors to consider for repair

3. Popliteal aneurysms

- a. Def'n: Often diameter > 2cm (variable sizes of native popliteal arteries (0.5 – 1.1cm) requires a fluctuating definition of the size cutoff)
- b. Epidemiology:
 - i. 95% occur in males
 - ii. Contralateral popliteal aneurysms found in ~50%
 - iii. AAA found in ~40%
- c. Symptoms
 - i. Often asymptomatic pulsating mass behind knee
 - ii. Minority will experience pain in area from compression
 - iii. Acute ischemia may result if aneurysm sac thrombosis or causes peripheral emboli
- d. Physical Examination:
 - i. Pulsatile mass in area of popliteal artery
 - ii. Required to examine for AAA due to high association
- e. Imaging
 - i. CTA or traditional angiography is used to determine size and potential treatment
- f. Risks:
 - i. Limb ischemia: 35% risk of thrombosis at 3yrs, with 25% risk of amputation.
 - ii. Rupture is rare
- g. Treatment: Often done when aneurysm size reaches 2-3cm
 - i. Open Repair:
 - 1. Bypass and ligation, or interposition grafting
 - 2. Improved patency rates as compared to endovascular.
 - ii. Endovascular Repair:
 - 1. A feasible approach for those patients too unwell for open repair.

4. Ruptured Aneurysms

- a. Def'n: An acute and often lethal condition. Rupture of the aorta will result in rapid deterioration of a patient unless the bleeding is contained.
- b. Symptoms/PE
 - i. Triad for rupture AAA: abdominal pain, shock, pulsatile abdominal mass
- c. Approach:
 - i. Establish adequate venous access for resuscitation (2-3 16G)
 - ii. Activation of the vascular team without delay
 - iii. Activation of transfusion protocol
- d. Imaging can be difficult as these patients quickly deteriorate
 - i. If the patient is hemodynamically stable a CTA will establish if an endovascular approach can be offered
- e. Open vs endovascular
 - i. Dependent on aneurysm anatomy and stability of patient
 - ii. If able, an aortic angiogram can be performed in the OR to determine if there is an endovascular option

SELECTED TOPICS: LOWER LIMB ISCHEMIA

1. Vascular Claudication

- a. Def'n: Burning/Cramping/Aching pain occurring consistently with activity, and alleviated by short bouts of rest.
- b. Risk factors:
 - i. Advanced age, race (non-Hispanic blacks), male gender, diabetes, dyslipidemia, smoking, hypertension, hypercoagulability, chronic kidney diseases
- c. Physical Exam
 - i. Blood pressure in both upper extremities
 - ii. Peripheral pulse assessment (presence, strength, and character)
 - iii. Lower extremity motor and sensory exam
 - iv. Muscle wasting, thin and dry skin, or ulceration may be present
- d. Neurogenic claudication: pain caused by lumbosacral nerve root impingement
 - i. Often worse walking downhill, and pain is positional
- e. Noninvasive imaging vs invasive imaging (CTA/angiogram)
 - i. Hematologic evaluation: CBC, fasting blood glucose, creatinine, fasting lipid profile, urinalysis
 - ii. Ankle Brachial Index (ABI): ratio of blood pressure in the lower legs to the blood pressure in the arms
 1. ABI of >1.2: Calcification of arteries
 2. ABI of 0.9 – 1.2: Normal
 3. ABI of <0.9: Suggests arterial stenosis
- f. Conservative management
 - i. Antiplatelet therapy: ASA 75-325mg daily
 - ii. Smoking cessation
 - iii. Exercise training: develops collateral vessels
 - iv. Cholesterol therapy: Statins and diet modification

SELECTED TOPICS: LOWER LIMB ISCHEMIA

2. Acute Limb Ischemia

a. Def'n: Sudden deterioration in the arterial supply to a limb.

i. Causes: Thrombosis, embolus, trauma, iatrogenic

b. Classification

| Category | Description or Prognosis | Sensory Loss | Motor Weakness | Arterial Doppler | Venous Doppler |
|----------|---------------------------------------------------------------------------|------------------------------------------|----------------------|------------------|----------------|
| 1 | Not immediately threatened | None | None | Audible | Audible |
| 2a | Threatened – marginally. Salvageable if immediately treated | Minimal (toes) or none | None | Inaudible | Audible |
| 2b | Threatened – Immediately. Salvageable with immediate revascularization | More than toes. Associated rest pain. | Mild – Moderate | Inaudible | Audible |
| 3 | Irreversible – Major tissue loss or permanent nerve damage inevitable | Profound – Anesthetic | Profound – Paralysis | Inaudible | Inaudible |

c. Conservative

i. Anticoagulation: IV Heparin is given initially as a bolus followed by a continuous infusion

1. Class 1 and 3 benefit from anticoagulation until an OR can be scheduled for definitive treatment

SELECTED TOPICS: LOWER LIMB ISCHEMIA

d. Invasive

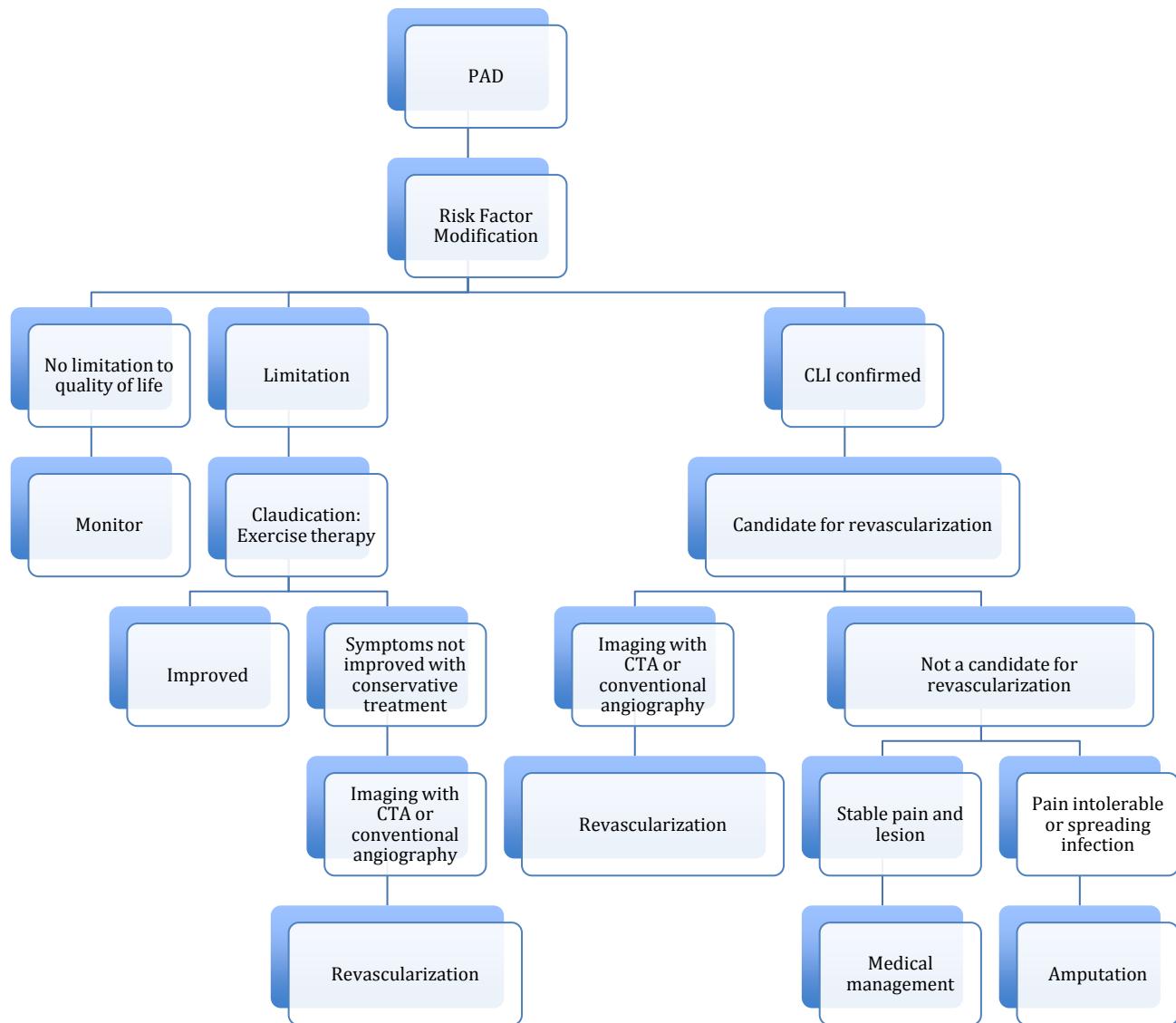
- i. Operative embolectomy
 1. Embolus can be removed percutaneously with Fogarty catheter. Subsequent bypass may be required
 - ii. Operative thrombectomy
 1. Thrombus removed through open arterial dissection, and usually surgically bypassed
 - iii. Catheter directed thrombolysis
 1. Dissolves clot in both large and small arteries
 2. Absolute contraindications: recent stroke or neurosurgery within 2 months, major surgery within 2 weeks, those at significant risk of bleeding
- e. Compartment syndrome: Increase in intracompartmental pressure impairing tissue perfusion
- i. Paresthesia, Poikilothermia, Palor, Pulselessness, Paralysis
- f. Reperfusion of ischemic tissue presents a high risk of compartment syndrome.
- i. Fasciotomy required for Class 2b or 3 acute ischemia

3. Critical Limb Ischemia

- a. Def'n: chronic lower extremity PAD and ischemic rest pain or the ischemic changes of non-healing ulcers and gangrene
 - i. Typically symptoms present > 2 weeks
 - ii. ABI < 0.5
 - iii. 1 year outcomes:
 1. 45% alive with 2 limbs
 2. 30% amputation
 3. 25% mortality

b. Classification

| Fontaine Grade | Rutherford Category | Clinical Description |
|----------------|---------------------|----------------------|
| 0 | 0 | Asymptomatic |
| | 1 | Mild claudication |
| 1 | 2 | Moderate |
| | 3 | claudication |
| 2 | 4 | Severe claudication |
| | 5 | Ischemic rest pain |
| 3 | 6 | Minor tissue loss |
| | | Major tissue loss |



SELECTED TOPICS: MESENTERIC ISCHEMIA

1. Def'n: Occurs when perfusion of visceral organs fails to meet normal metabolic requirements
 - a. Acute: occurs rapidly over hours to days and frequently leads to acute intestinal infarction requiring resection
 - i. Embolic:
 - ii. Thrombotic:
 - b. Chronic: progresses over weeks to months
 - i. Most commonly as a result of progressive atherosclerosis
2. Symptoms/PE
 - a. Acute:
 - i. Sudden onset abdominal pain. Classically the pain is out of proportion to findings on clinical exam
 - ii. Late findings of peritonitis, vomiting, bloody stools, and shock are worrisome
 - b. Chronic:
 - i. Abdominal pain – dull/crampy (intestinal angina) most commonly after meals (post prandial) or when gut is stressed requiring increased blood flow
 - ii. Sitophobia (fear of eating)
 - iii. Weight loss
3. Imaging
 - a. CTA: gives good visualization of splanchnic vasculature, pathology of occlusion, other intrabdominal findings and treatment planning

4. Conservative management
 - a. Medical treatment alone is not effective. Lower other cardiovascular risk factors may improve prognosis.
5. Operative management
 - a. Endovascular: if anatomically suitable, angioplasty or a stent may be placed in the area of occlusion or stenosis
 - b. Open repair: often patients will require resection of ischemic bowel, at this time a surgical bypass may be performed or a hybrid procedure with angioplasty +/- stenting

SELECTED TOPICS: CAROTID DISEASE

1. The primary goal of treatment of cerebrovascular disease is prevention of stroke, most commonly from embolic plaque
2. TIA: last 1-10min with complete resolution and can include the following symptoms:
 - a. Embolic symptoms:
 - i. Transient monocular blindness or field cuts
 - ii. Dysarthria (disturbance in articulating)
 - iii. Dysphasia (disturbance in communication)
 - iv. Aphasia (disturbance in formulation or comprehension of language)
 - v. Monoparesis (single limb weakness)
 - vi. Hemiparesis (unilateral weakness)
 - vii. Hemisensory deficit
 - b. Hypoperfusion symptoms
 - i. Bright light amaurosis
 - ii. Lightheadedness or presyncope associated with any of the above focal deficits
3. Imaging
 - a. Ultrasound good initial test that is noninvasive
 - b. If unable to obtain ultrasound a CTA or MRA can be performed

SELECTED TOPICS: CAROTID DISEASE

4. Evidence for intervention

| Study | Stenosis | # of pts | Endpoint | Medical | Surgical | Absolute RR | Relative RR |
|-----------------------|----------|----------|-------------------------|---------|----------|-------------|-------------|
| NASCET Symptomatic | 70-99% | 659 | 2-yr ipsilateral stroke | 26% | 9% | 17% | 65% |
| ECST Symptomatic | 80-99% | 576 | 3-yr ipsilateral stroke | 20.6% | 6.8% | 13.8% | 67% |
| NASCET Symptomatic | 50-69% | 858 | 5-yr ipsilateral stroke | 22.2% | 15.7% | 6.5% | 29% |
| ACAS Asymptomatic | 60-99% | 1662 | 5-yr ipsilateral stroke | 11% | 5.1% | 6.1% | 53% |
| ACST Asymptomatic | 60-99% | 3120 | 5-yr any stroke | 11.8% | 6.4% | 5.4% | 46% |

SELECTED TOPICS: RISK REDUCTION

| Disease | Systolic BP (mmHg) | Diastolic BP (mmHg) | Tx |
|-----------------|-----------------------|------------------------|-------------------------------------------------------------------|
| Prehypertension | 120 – 139 | 80 – 99 | Lifestyle changes |
| Stage 1 HTN | 140 – 159 | 90 – 99 | Lifestyle + 1 of: Thiazide diuretics, ACEI, BetaBlocker, ARB, CCB |
| Stage 2 HTN | >159 | >99 | Lifestyle + 2 of: Thiazide diuretics, ACEI, BetaBlocker, ARB, CCB |

| Disease | Goals | Tx |
|----------------|----------------------------------------|-------------------------------------------|
| Hyperlipidemia | LDL < 2.59 mmol/L HDL > 1.30 mmol/L | Lifestyle + statins |
| Diabetes | HbA1c < 7% LDL < 1.8 mmol/L | Lifestyle + oral agents, consider insulin |

SELECTED TOPICS: COMMON MEDICATIONS

1. Thrombolytics: Some patients with acute limb ischemia that has an embolic source can be treated with catheter directed thrombolytics
 - a. Current recommendations:
 - i. Rutherford class I to IIa limb ischemia
 - ii. Symptoms of less than 14 days
 - b. Absolute contraindications:
 - i. Prior ICH or cerebral AVM or intracranial neoplasm
 - ii. Ischemic stroke within last 3 months
 - iii. Suspected aortic dissection
 - iv. Active bleeding
 - v. Significant closed head trauma
2. Antithrombotics
 - a. Platelet Inhibitors
 - i. ASA -
 - ii. Mechanism:
 1. Irreversible acetylation of COX1 → blocks synthesis of thromboxaneA₂
 2. Higher doses (1g/d) inhibits COX2 → blocks synthesis of prostacyclin → reduces vasodilation and inflammation
 - iii. Indications:
 1. Secondary prevention of cardiovascular events in patients with CAD/CVD/PVD → reduction 25% death/MI/stroke
 2. Primary prevention in pop. with risk MI >1%
 - a. Pts over 40yrs with 2+ major risk factors
 - b. Pts over 50yrs with 1+ major risk factors

SELECTED TOPICS: COMMON MEDICATIONS

- iv. Clopidogrel/Ticagrelor –
- v. Mechanism:
 - 1. Selective inhibition of ADP-induced platelet aggregation
 - 2. Clopidogrel requires CYP450 activation
 - a. When given in usual doses takes several days
- vi. Indications:
 - 1. Clopidogrel: Secondary prevention of cardiovascular events in patients with CAD/CVD/PVD → 8.7% reduction when compared to ASA
 - a. Clopidogrel + ASA
 - i. X6 weeks after bare metal stent for CAD
 - ii. Longer for drug eluting stent
 - iii. Unstable angina (20% RR compared to ASA)
 - b. Bleeding risk 2.7%/yr
 - 2. Ticlopidine: Used for secondary prevention of cardiovascular events in patients with CAD/CVD/PVD

SELECTED TOPICS: COMMON MEDICATIONS

b. Thrombin inhibitors

i. Heparin –

ii. Mechanism:

1. Activates antithrombin and accelerates the rate
antithrombin inhibits → Thrombin + factor Xa
 - a. Induces conformational change in
antithrombin making its reactive site more
accessible (2x for Xa)
 - b. Binds directly to antithrombin and thrombin
bringing reactants closer together

ii. Pharmacology:

- a. In circulation heparin also binds to
endothelium and plasma proteins → dose
dependent clearance
- b. Reversible with protamine sulfate: full
reversal is 100:1 dose

iii. Heparin Induced Thrombocytopenia (HIT)

1. Triggered by Ab release against PF4-Heparin
complex
 - a. Causes release of platelet microparticles
 - b. Prothrombotic
2. Stop Heparin → give alternative anticoagulant →
No platelet transfusion → No warfarin (acute
protein C decrease can lead to necrosis) → Eval for
DVT

ii. LMWH –

iii. Mechanism:

1. Activates antithrombin (even more affinity for Xa
than heparin)
2. Not able to bring antithrombin and thrombin
together

SELECTED TOPICS: COMMON MEDICATIONS

c. Oral Anticoagulation

i. Warfarin –

ii. Mechanism:

1. All of the VitK dependent clotting factors (2,7,9,10) require carboxylation, which permits Ca binding
2. The enzyme responsible is VitK dependent carboxylase
3. During the reaction VitK is oxidized to VitK-hydroquinone
4. VitK-hydroquinone is then reduced to VitK epoxide, which is then reduced to VitK by VitK epoxide reductase (VKOR)
5. Warfarin inhibits VKOR
6. Dependent on reduction in the functional levels of factor X and prothrombin, which have half lives of 24 and 72hrs respectively → therapeutic levels take time

iii. Pharmacology:

1. Rapidly and almost completely absorbed by GI tract
2. Peak blood levels 90min after ingestion
3. Racemic mixture of R-S enantiomers, which are each metabolized in the liver via distinct pathways
4. The more active S-isomer metabolized by CYP2C9
 - a. Patients with variance of this allele may require lower doses of warfarin
5. Reversible with oral (faster) or IV dosed Vit K, or octaplex

POST OPERATIVE ORDERS:

a. AAA

iii. Open

1. NPO
2. Bedrest x24hr then AAT (PT/OT)
3. Monitored bed
4. NS @200cc/hr x 24hr (reassess frequently)
5. Ancef/Vanco x24hr
6. Daily BW (CBC/lytes/BUN/Cr/INR/PTT)
7. DVT prophylaxis (Fragmin/Heparin)
8. Hold antihypertensives
 - a. Except BetaBlockers (if SBP>120)
 - b. Resume coumadin POD#2 (bridge if valve/stroke/PE)

iv. EVAR

1. CF – DAT
2. Bed rest x24hr then AAT (PT/OT)
3. Monitored bed
4. NS @125-150cc/hrx 24
5. Ancef/Vanco x24hr
6. BW x 1
7. DVT?
8. Home medications as per usual

POST OPERATIVE ORDERS:

- c. Fem – Pop/Tib
 - 1. CF - FF
 - 2. Bedrest x24hr then AAT (PT/OT)
 - 3. Monitored bed
 - 4. NS @125cc/hr x 24hr
 - 5. Ancef/Vanco x24hr
 - a. If inf. Pip/Tazo x48hr then Amox-Clav x5days
 - 6. Daily BW (CBC/lytes/BUN/Cr/INR/PTT)
 - 7. DVT prophylaxis (Fragmin/Heparin)
 - 8. Hold antihypertensives
 - b. Except BetaBlockers (if SBP>120)
 - c. Resume coumadin POD#2 (bridge if valve/stroke/PE)
 - d. Daily ASA
- d. AKA/BKA
 - 1. DAT
 - 2. Bedrest x48hr
 - 3. PT/OT/SW
 - 4. Monitored bed
 - 5. NS @125cc/hr x24hr
 - 6. Acef/Vanco x24hr
 - a. If inf. Pip/Tazo x48hr then Amox-Clav x5days
 - 7. Daily BW (CBC/lytes/BUN/Cr/INR/PTT)
 - 8. DVT prophylaxis (Fragmin/Heparin)
 - 9. Hold antihypertensives
 - a. Except BetaBlockers (if SBP>120)
 - b. Resume coumadin POD#2 (bridge if valve/stroke/PE)
 - c. Daily ASA

4. POST OPERATIVE ORDERS:

a. Carotid Endarterectomy

1. NPO x24hr then DAT
2. Bedrest x24hr
3. Monitored bed
4. NS @125cc/hr
5. Ancef/Vanco x24hr
6. BW x 1
7. DVT? – Encouraged to walk and not generally given
8. Home meds as usual