Aorta /carotid disease

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Carotid Stenosis

• **Significance**
  • More than 500,000 strokes/year, third leading cause of death
  • 85% of all strokes are ischemic and atheroembolism is the most common cause, most from carotid stenosis.

• **Diagnosis**
  • Bruit is a nonspecific sign of atherosclerosis. 33% have carotid pathology
  • **Duplex ultrasound**
    • Gives hemodynamic and anatomic evaluation
    • Has become the main diagnostic test, follow up, screening
    • Can perform surgery with Duplex if results shown to be accurate
  • **MRA**: safe, companion to Carotid Ultrasound
  • **CT angio**: most commonly used now
  • **CT Head Scan**: Indicated in patients with neurologic deficits.
  • **Conventional Angiography**
    • Used to be gold standard
    • Can visualize arch and intracranial circulation
    • 1% incidence of stroke
Operative management

- Careful dissection to avoid embolization and injury to vagus, hypoglossal; ansa cervicalis can be sacrificed. Nerve injury 14% (1% permanent)
- Shunting is controversial: routine, selective (based on stump pressure, EEG, transcranial Doppler, evoked potentials, awake patient), or never (never never)
- Most believe patching decreases recurrent stenosis.
- Some believe eversion technique decreases recurrent stenosis. Most suitable for kinked carotid
- Intraoperative Doppler, duplex, angiogram, to monitor reconstruction
- Stroke risk < 2-3 %
STANDARD CAROTID ENDARTERECTOMY

Endarterectomy plane developed

Plaque is removed
CAROTID ARTERY PATCH CLOSURE AFTER ENDATECTOMY
Carotid Stenosis cont...

• **Presentation**
  - Asymptomatic
  - **TIA** transient ischemic attack: hemispheric neurologic deficit that resolves within 24 hours
  - Amaurosis fugax: transient monocular blindness from embolization to the ophthalmic artery, a branch of the internal carotid artery
  - **RIND** reversible ischemic neurologic deficit: resolves within 3 days
  - Stroke
Indications for carotid endarterectomy

- **NASCET** symptomatic > 50-99% ICA stenosis
  - Randomized patients with TIA, amaurosis, or mild stroke to surgery or antiplatelet therapy
  - Cumulative ipsilateral stroke rate at 2 years: 9% with surgery, 26% with medical therapy

- **ACAS** asymptomatic 60-99% ICA stenosis
  - Cumulative ipsilateral stroke rate at 5 years: 5% with surgery, 11% with medical therapy
  - Usually wait 6 weeks after acute stroke but some studies show safety in early operation when head CT without large lesion
  - Not indicated for total occlusion (unless acute) or severe stroke
  - 60 -80% benefit from CEA is marginal, so risks from surgery should be considered.
NORTH AMERICA SYMPTOMATIC CAROTID ENDARTERECTOMY TRIAL (NASCET)

Demonstrated benefit of carotid endarterectomy in patients with:

* hemispheric or monocular TIAs or prior mild stroke with > 50% stenosis
* crescendo TIAs and stenosis > 50%

No benefit if stenosis < 30%

Variable benefit in patients with 30-50% stenosis
NASCET Study

Event Free

Months

0 6 12 18 24

0 100

Yellow: Medicine
Green: Surgery
ASYMPTOMATIC CAROTID ATHEROSCLEROSIS STUDY (ACAS)  1995

Evaluated 1622 patients with 60-99% stenoses

Study halted early by safety review board in favor of CEA

At five years, risk of stroke with medical treatment 11%;
   with surgical treatment 5.1%

Relative risk reduction of 53%; absolute risk reduction 1%/year

Approximately half of the strokes in the surgical group were
   secondary to the arteriogram
Postoperative management

- Neck hematoma: evacuate unless small and stable
- Early postoperative stroke: heparin, re-exploration, thrombosed repair, consider intraop angiogram
- Early postoperative TIA: Duplex
- Hyperperfusion syndrome
  - Usually 3-5 days postop
  - Severe headache, can have focal neurologic deficit, coma
  - Control hypertension, rule out intracerebral hemorrhage.
Left subclav steel with complete cir of Wills
Aortic Diseases

Ahmed Mahmoud, MD
Abdominal Aortic Aneurysms

A. Etiology

1. Atherosclerotic, degeneration

2. Genetic role due to high incidence in family members (11-fold risk in first-degree relative)

3. Pathogenesis unknown: theories include abnormal collagen and elastin, increased matrix metalloproteinases or decreased inhibitors, increased plasmin activity, immunologic, flow disturbances, and inflammatory
Presentation

• Asymptomatic in 75% at time of diagnosis
• Local mass effects on the GI tract, lumbar spine, ureters
• Thrombose
• Embolize
• Rupture
Risk of rupture (5 year)

- 7 cm or larger — >75%
- 6 cm — 35%
- 5-5.9 cm — 25%
Risk of Rupture Cont.

- < 4 cm - 0% per year
- 4-5 cm - 0.5%-5% per year
- 5-6 cm - 3%-15% per year
- 6-7 cm - 10%-20% per year
- 7-8 cm - 20%-40% per year
- > 8 cm - 30%-50% per year
Diagnosis

• Physical exam, limited in obese patients and small aneurysms

• Sometimes seen on plain x-ray by calcified rim

• **Ultrasound** good for screening and follow up

• **CT very accurate**
  • Delineates extent, suprarenal or iliacs
  • Identifies inflammatory aneurysms
  • Shows abnormal anatomy (horseshoe kidney, duplicated vena cava, left sided vena cava, retroaortic renal vein (5%), tumors)
  • Sufficient preop imaging for most cases
Aortography

- Does not accurately show size because of intraluminal thrombus
- Not necessary pre-op unless suprarenal, suspect mesenteric and renal stenosis, iliac occlusive disease
Most located infrarenal
Operative repair

- Repair when 5 cm or larger
- Expansion 5 mm/6 month period
- Elective **preoperative Cardiac** evaluation: Stress test, thallium, dobutamine echo, or coronary cath.
- Dacron or PTFE graft replacement
- **Retroperitoneal approach** for hostile abdomen suprarenal involvement, may have decreased pulmonary complications, not ideal when R iliac involved
- **IMA** usually ligated (80%) but *reimplant if poor back-bleeding, low pressure, previous colectomy, neither internal iliac patent*
- **Associated pathology:** Cancer and AAA, treat the more severe/symptomatic problem first. AAA it’s the size, Cancer it’s the obstruction/bleeding problem
Early complications

- Post-Op MI
- Renal failure from embolization or hypotension
- Trash foot from embolization
- Ischemic colitis
  - Suspect when early BM, diarrhea
  - Sigmoidoscopy to assess degree of ischemia and need for colectomy
- Ureteral injury
- Sexual Dysfunction
- Injury to sympathetic plexus over left common iliac artery
- Retrograde ejaculation 66%, Impotence 33%
Late complications >1 year

- Anastomotic aneurysm: should be repaired
- Graft infection: requires removal and extra-anatomic bypass, some advocate in-situ replacement with cryovein

- Aortoenteric fistula
  - Usually to third/fourth part of duodenum from proximal anastomosis
  - Presents with GI bleeding, suspect if previous graft
  - Requires prompt endoscopy, in OR if massive bleeding
  - CT scan to look for perigraft air and fluid in stable patient if endoscopy negative
  - Treat as for infected graft with bowel repair.
Ruptured AAA

• 50% mortality before hospital, 50% mortality for those arriving to hospital
• Presents with abdominal and back pain, shock, pulsatile abdominal mass
• Prompt operation, CT only in stable patients with unclear diagnosis
• Prep and drape before induction.
• Resuscitate after supraceliac aortic control.
Endovascular stent graft repair

• Recognized, safe option
• Needs suitable anatomy
• Should be considered in high risk patient, esp. elderly
• Definitely decreases hospital stay, blood loss, and post op complications
• Needs frequent follow up and imaging
• Conversion open rate 5%
• Mortality 1-5 %
Anatomic Criteria

- Proximal neck length $>15\text{mm}$
  - Diameter $<28\text{mm}$
- Tube graft: distal cuff length $>10\text{mm}$
  - Diameter $<28\text{mm}$
- Iliac artery diameter $>7\text{mm}$ and $<15\text{mm}$
  - Minimal to moderate tortuosity
- No mural thrombus at attachment sites
  - Minimal calcification
- No associated mesenteric occlusive disease
AAA Repair

• Two types of repair performed

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<tr>
<th>OPEN</th>
<th>ENDOVASCULAR</th>
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<td>First performed 1951</td>
<td>First performed 1991</td>
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<td>▪ Now involves placement of Dacron or PTFE graft</td>
<td>▪ Less invasive, done through femoral vessels</td>
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<td>▪ 2-4% operative death rate, 5-10% complication rate</td>
<td>▪ Only certain types of AAA can be repaired</td>
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AneuRx

- Medtronic (TALENT)
- Modular bifurcated with extension cuffs
- Graft—thin walled polyester
- Stent—outer self expanding Nitinol stents
- Delivery—25F introducer sheath (now 18 F)
  - Mechanical deployment handle
Endoleak Classification

• Type I—perigraft
  • Persistent flow at *proximal or distal* attachment sites

• Type II—retrograde flow from side branches
  • Inferior mesenteric or lumbar arteries
  • Subgroup A: inflow only; B: in and outflow

• Type III—graft defect

• Type IV—graft porosity
  • Primary or secondary
Type III endoleak - types I, II
Changes in Aortic Morphology

• Aneurysm diameter
  • Growth in size associated with persistent endoleak

• Neck size
  • Annual expansion 0.7mm 1\textsuperscript{st} year, 0.9mm 2\textsuperscript{nd} year
  • May lead to migration and late endoleaks

• Aneurysm length
  • Shortens >5mm in 68% patients at 12mos
  • Associated with kinking and dislocation
Iliac Aneurysms

- Usually extension of AAA (20% involve iliacs), uncommon as an isolated aneurysm
- Occurs in common or internal iliac, rarely in external iliac
- Internal may be palpable on rectal exam
- Replace common iliac aneurysm with graft
- Ligate and oversew branches of internal iliac aneurysm.
- Can also be safely repaired with covered stent-graft (Viaban from Gortex)
Splenic Artery Aneurysms

- Most common visceral aneurysm (60%) but still rare (<1%), most common in women (4:1), especially multiparous
- Medial degeneration of arterial wall
  - Associated with multiple pregnancies, fibromuscular dysplasia, portal hypertension, pancreatitis
  - Calcification in up to 70%
Risk of rupture

- 95% of splenic aneurysms diagnosed during pregnancy are ruptured, with 70% maternal mortality and up to 95% fetal mortality.
- 2% of asymptomatic aneurysms in nonpregnant patients, 25% mortality
- Double rupture phenomenon, first into lesser sac, then peritoneal cavity
Indications for treatment

• All symptomatic aneurysms, usually LUQ or epigastric pain, radiation to L subscapular area
• Aneurysms discovered in women who are pregnant or plan to be
• Aneurysms > 2-3 cm in very good risk patients with expected mortality < 1%
Treatment options

• Aneurysmectomy or ligation (reconstruction rarely indicated), with splenectomy if distal
• If associated with pancreatitis, may require distal pancreatectomy or pseudocyst drainage
• Percutaneous transcatheter embolization in high-risk patients