Cardiac Catheterization

What is the purpose?

The most definitive way to identify and diagnose CVD
Can determine if any vessels are blocked, congenital issues, CAD, blood flow issues, valve issues, oxygenation
May use US at the same time
Con: expensive

Pre-Procedure

Treat like surgery--*cannot* do without consent for cath AND heart surgery
Use dye to see how blood perfuses through the arteries
Ask person to cough = changes intrathoracic pressure (helps to move dye
Give fluid (dye is dehydrating & damages kidneys)

Post-Procedure

Less limitation w/ radial, lay flat
Femoral: check pulses & mark w/ X's, make sure same strength
Biggest complication: arrhythmias, **bleeding** (check all around wrist/leg, every time heart is accessed = inc. risk for a fib)
Pay close attention! High risk for problems!

If pt is allergic to dye: give Benadryl (anti-histamine), Tylenol (anti-pyretic), Hydrocortisone (steroid)

L- vs. R-Sided Cardiac Cath

R-Sided Cath: inc. risk for PE or vagal nerve (= pass out)

L-Sided Cath: inc. risk for MI

Both: inc. risk for cardiac tamponade

Cardiac Tamponade: *pericardial sac fills w/ blood = inc. pressure on heart*

Mean Arterial Pressure (MAP)

Systolic BP + [(2 x Diastolic BP) / 3]

Example: 125/75
125 + [(2 x 75) / 3]
MAP = 92 mm Hg

*MAP must be at least **60+ (60-70 mm Hg)** for adequate coronary pressure!*

Monitoring

Hemodynamic Monitoring: used to look at pressure in the heart
- Pt must lie flat to zero out the heart

Invasive vs. Non-Invasive

Central Venous Pressure (CVP): R atrial pressure; mirrors fluid status in the body

Arterial Lines: accurately monitor BP & MAP; may be radial, brachial

Pulmonary Artery Catheter: R artium to R ventricle to pulmonary arteries
- Can compare R and L side pressures
- Example: SWAN catheter

Allen's Test

1. Hold both arteries. (Hand blanches white.)

2. Open hand and release ulnar artery. (Hand should pink up.)

Pink hand = safe to use

Diagnostic Studies

Electrophysiology Studies (EPS): looks at intracardiac conduction system
- Identify arrythmias
- Differentiate between arrythmias, if person needs pacemaker/ICD, are meds effective = may need to take for surgery

PET Scan: compares cardiac perfusion & metabolic functions
- If mismatched = ischemia

MRI/MRA: may use dye & do angiography at the same time

Electronic-Beam Tomography: similar to CT scan but more for the heart

Disorders of Myocardial Perfusion

Coronary Artery Disease: ACS & atherosclerosis

Acute Coronary Syndrome (ACS): results from fibrous tissue & plaque accumulation
1. Unstable angina
2. NSTEMI
3. STEMI

Disorders of Myocardial Perfusion (cont)

Atherosclerosis: often takes years
- Response to injury theory: fatty streaks → fibrous plaques → plaques rupture & form thrombus → inflammatory cells (clot forms on plaque & clot breaks free)

Angina

Causes: myocardial ischemia (dec. supply & inc. demand), aortic stenosis, cardiomyopathies

Assessment: pain, onset, duration, severity

Types:
- *Stable*: at expected time (ex: w/ exercise)
- *Unstable*: pain "for no reason", no predictable pattern; indicates major coronary event
- *Nocturnal Angina*: wake up in the middle of the night

Diagnosis: get an EKG, change in ST segment = something going on
* CHEW an aspirin

Pharmacological Interventions:
- *Aspirin* (dec. platelet aggregation)
- *Nitrates/anti-anginals* (coronary vasodilators, not selective for cardiac vessels (= MASSIVE HA, pass out = wear gloves!)
- *Beta-blockers* (dec. HR = dec. O_2 demand, open blood vessels = inc. circulation)
- *Statins* (dec. plaque buildup)
- *CCB* (dec. heart contractility [of smooth muscles in arteries = vasodilate] & O_2 demand)
- *ACEI* (help to vasodilate = dec. BP = dec. afterload & makes it easier for heart to work)

BIGGEST CONCERN = pain relief → inc. O_2 demand and perfusion

Lifestyle Changes:
- *Diet*: no smoking, healthy diet (dec. sat fat & processed foods), control cholesterol
- *Exercise*
- *Lipids*: control & check levels
- *Weight*: lose if possible
- *Comorbidities*: control them!
- Other: *avoid stress* (= inc. plaque, constricts blood flow)

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Myocardial Infarction (MI)

Assessment: CP unrelieved/unrelenting, nausea, dyspnea
- Not everyone gets arm/jaw pain

Diagnosis: EKG! (ST-seg changes) & inc. enzymes (trop, CK-MB, others; WBC r/t inflammation)

Severity depends on which vessel is blocked

STEMI: complete occlusion of a major vessel w/ full thickness damage
- Inc. risk for complications
- 10-15% mortality rate during admission
1. Inc. enzymes
2. Inc.
3. Inc. risk of complications

Non-STEMI: complete occlusion of a minor coronary artery OR partial occlusion of a major coronary artery
- Mortality rate = 3-5%
- Happens more w/ vasospasm

Troponin level correlates to damage!

Heart Zones
- Zone of ischemia: *T-wave inversion* - can come back
- Zone of injury: *ST elevation*
- Zone of necrosis: *abnormal Q* = never coming back

Surgical MI Interventions

Coronary Artery Bypass Graft (CABG)

1. **On-Pump**: put pt on bypass machine, reoxygenate blood and return to body
- Heart stopped = inc. risk for complications (bleeding, stroke, etc.)

2. **Off-Pump**: risks w/ beating heart

Venous graft & placement: *mammary vessels* are best, preferred for off-pump
Minimally Invasive Direct Coronary Artery Bypass (MIDCAB)
- Dec. healing time
- Dec. time in critical care
- Off-pump procedure

MI Interventions

Revascularization: first choice treatment

Percutaneous Coronary Intervention (PCI): invasive; a catheter is placed in a coronary artery to remove a blockage
- Includes: *balloon angioplasy*, *atherectomy*
- Revascularize & reoxygenate
- Want to do ASAP for STEMI
- May treat NSTEMI a bit more medically

Percutaneous Transluminal Coronary Angioplasty (PCTA): inflated balloon compresses plaque against artery walls
- May need to premeditate for allergies
- May bleed
- May have MI (dislodge clots)
- May worsen kidney problems
- May have a fib, V-tach

Atherectomy

Stent: a metal cage holding plaque against the vessel
- Not a permanent fix, must change lifestyle
- Various types

Thrombolytic Therapy: used w/ pt contraindicated for surgery
- Want to give within 12 hr
- **Tissue plasminogen activator (TPA)**
- Worry about hemorrhagic strokes - will cause bleeding = carefully monitored

Laser: burns out plaque
- Next choice if can't do within minutes

Transmyocardial Laser

Intra-Aortic Balloon Catheter: artificial L ventricle; can pump blood
- Inc. contractility of heart & workload by pumping for heart
- MI: balloon can pump and heart can rest
- In sync w/ conduction system
- *Frequently check and compare pulses*
- Complications: dissected aorta, plaques can break if in aorta, _____, can burst

Pharmacological Interventions

Heparin/Coumadin (prevent clot formation)

Nitrates (inc. circulation, area well-perfused)

Narcotics (morphine - dec. O_2 demand and pain control)

Adjunct meds: **Beta-blockers**,**ACEI**, **statins**

Oxygen (Always; issue of supply & demand)

Post-Op Care

Highest risk for...

Dec. CO	Pulmonary edema
Dysrhythmias	Pericarditis
Cardiogenic shock	Cardiac tamponade
CHF	

Post-Op Assessments

(BOLT Handout)

Pacer wires connected just in case

Cardiac Tamponade: change in HR & BP; filling of pericardial sac with blood/fluid
- **BIGGEST RISK!**

Beck's Triad =
1. *Muffled heart sounds*
2. *JVD* w/ neck assessment
3. *Hypotension* (can't effectively contract)

After 6 hr, lines pulled and extubated

Post-Op Evaluation

Improved tissue perfusion

Pain diminished or absent

Anxiety/fear diminished

Cardiac Rehab:
Phase 1 - in hospital, walk w/ telemetry
Phase 2 - D/C to rehab exercise program
Phase 3 - Follow-up & continue w/ exercise

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