## 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)

## 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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