

Coronary Angiography

Indication & Limitation

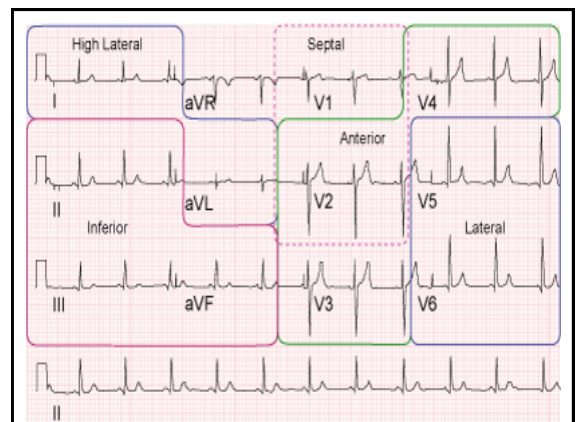
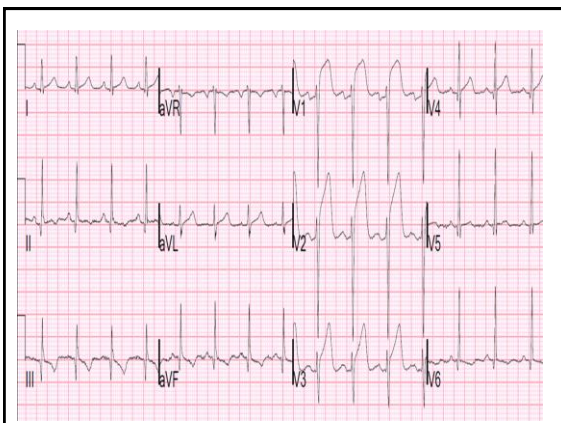
- Cardiac catheterization requires the use of **fluoroscopy** to visualize the path of the catheter as it enter the coronary arteries.
- During coronary angiogram, a type of dye that is visible by an X-ray machine is injected into the blood vessels. The x-ray machine rapidly takes a series of images offering a look at coronary vessels.

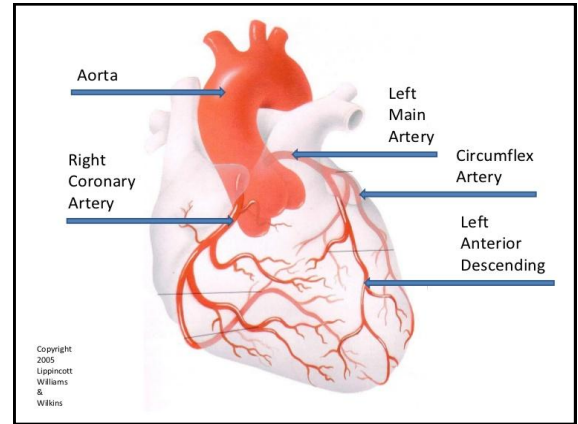
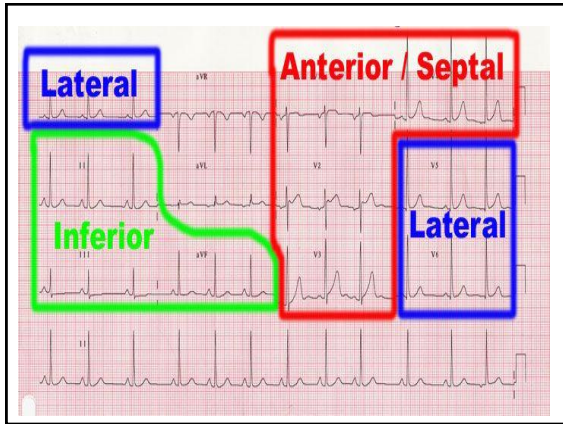
Introduction

- Coronary angiogram is part of general group of procedures known as **cardiac catheterizations**.
- Cardiac catheterization can both diagnose and treat heart and blood vessel conditions.
- Cardiac catheterization is a minimally invasive procedure to access the coronary circulation (coronary angiogram) and heart chambers (ventriculogram).

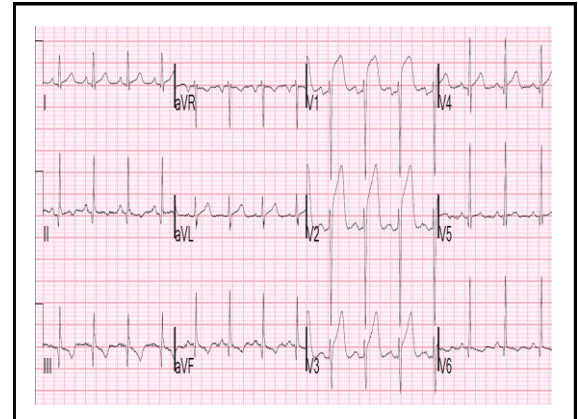
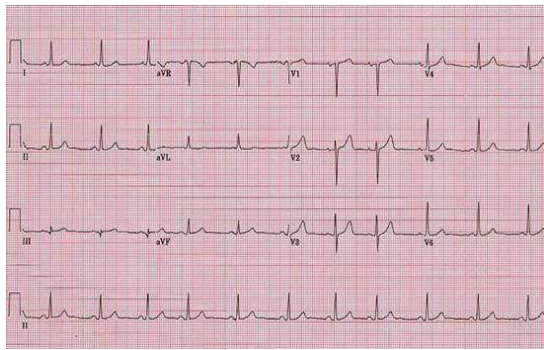
Case

- 55 years old gentleman, businessman, chronic smoker, hypercholesterolemia and diabetes mellitus.
- Developed acute central chest pain during meeting. Associated with palpitation, shortness of breath, lower jaw numbness.

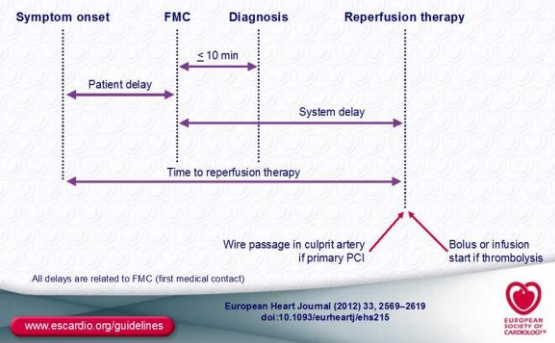




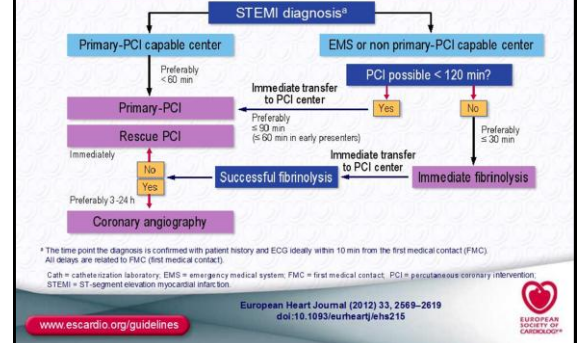
Normal ECG



Components of delay in STEMI and ideal time intervals for intervention



Prehospital and in-hospital management, and reperfusion strategies within 24 h of FMC



Indication for Coronary Angiogram

- Acute ST elevation MI
- Non- ST elevation acute coronary syndrome
- Unstable angina
- Stable angina
- Abnormal stress test
- Unexplained heart failure
- Dangerous cardiac arrhythmia
- Suspected Prinzmetal angina (coronary vasospasm)

Indication for Cardiac Catheterization

- Valvular heart disease
- Aortic dissection
- Congenital heart diseases
- Initial and follow up assessment for heart transplant

Contraindications

There is no absolute contraindication

Relative contraindications include:

- Coagulopathy
- Uncontrolled hypertension
- Fever from infection
- Decompensated congestive heart failure
- Pregnancy
- Active infection
- Renal failure
- Contrast medium allergy
- Inability for patient to cooperate

Complication & Risk

- Death
- Myocardial infarction
- Stroke
- Arrhythmia
- Coronary artery perforation, hemorrhage
- Contrast induced nephropathy

Overall risk is less than 1%

Pre-catheterization Care

- Informed consent obtained
- History taking
- Physical examination
- CXR
- Blood investigation
- ECG
- Echocardiogram
- Exercise stress test
- Cardiac perfusion studies

Pre-catheterization Care

- Branula
- Nil by mouth 4-6 hours before procedure

Cardiac Cath Lab



Ancillary Equipment

- Emergency trolley
- Oxygen & suction pump
- Defibrillator
- Temporary pacemaker
- Pulse oximetry
- Blood pressure cuff
- Activated clotting time (ACT) equipment

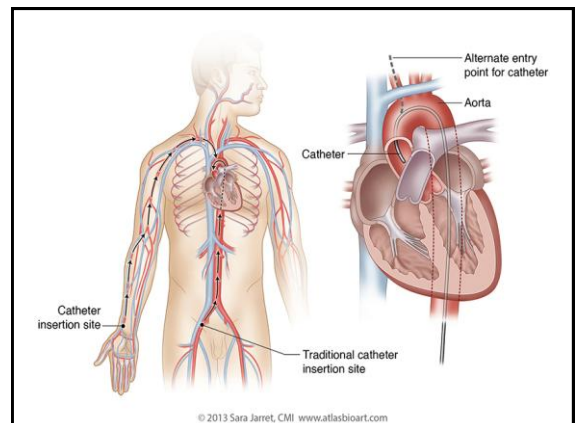
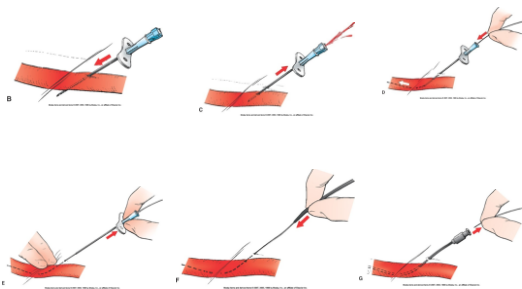
Patient Participation

- Patient is usually **awake during catheterization**, only local anesthesia and minimal general sedation given.
- Performing procedure with patient awake is safer as patient can immediately report any discomfort and facilitate rapid correction.

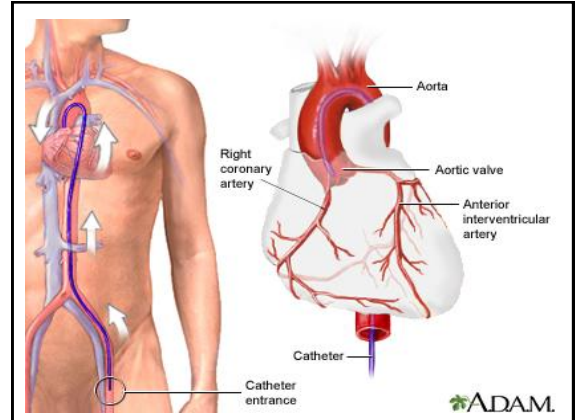
Catheter Introduction

- Prepare catheter introduction site with aseptic technique – shaved and cleaned
- Can be at femoral (most common), radial, brachial, jugular and subclavian areas.
- Seldinger technique used.

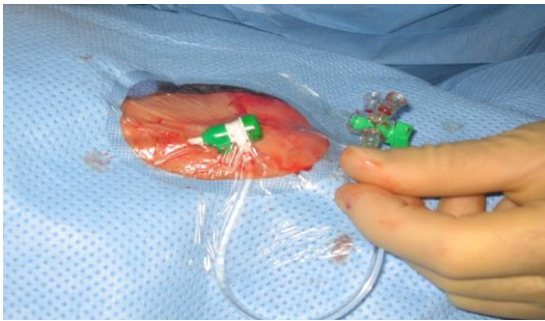
Seldinger Technique



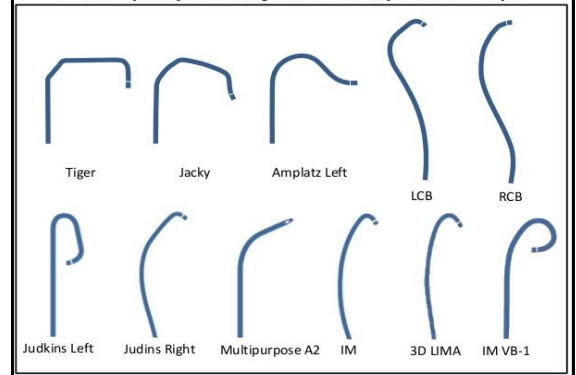
Transradial Approach



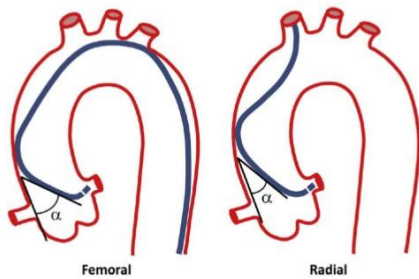
Transfemoral Approach



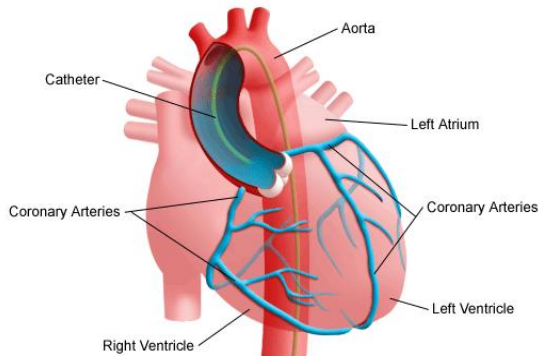
Most Frequently Used Diagnostic Coronary Catheter Shapes



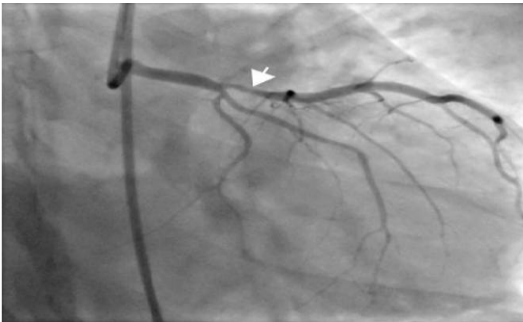
Femoral and Radial Are Different



Injection of Dye Into Coronary Arteries



LAD Stenosis



Data Collection

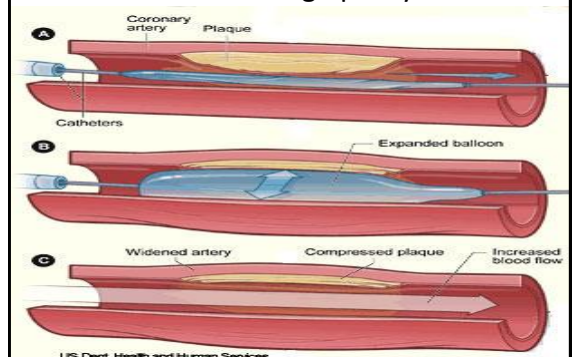
- Hemodynamic parameter- blood pressure
- ECG
- Oximetry readings
- Cardiac output
- Blood samples to measure oxygen saturation level

Interventional Procedures

Balloon angioplasty

- Also known as Plain old balloon angioplasty (POBA)
- Employs balloon to dilate the coronary artery stenosis
- The placement of the catheter is placed much in the same way as standard coronary angiography

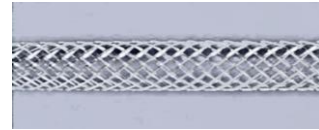
Balloon Angioplasty



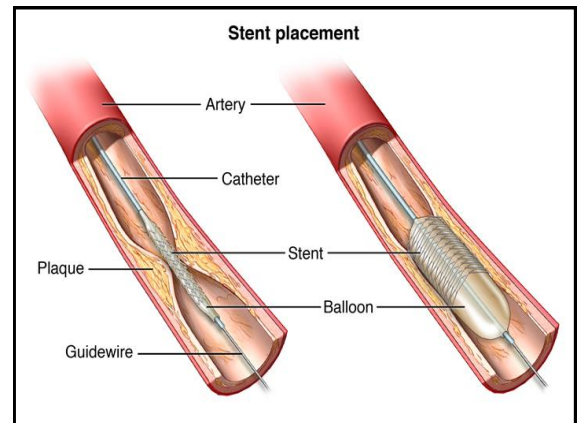
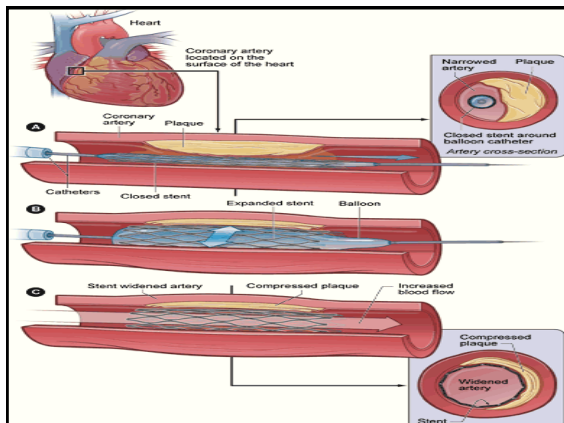
- Special steerable guide wire is used
- Guide wire is advanced to stenotic area using the balloon catheter
- Balloon is pushed through to the stenotic area
- Balloon is inflated and compress fatty deposits
- Followed by arteriography to make sure it blood is flowing
- This may be done repeated times to assure maximum dilatation
- Restenosis occurs in 30-50%

PTCA with Stent Placement

- Stent (tube-shape device) placed in the coronary arteries to keep the arteries open.
- Restenosis is lower.



PTCA - Percutaneous transluminal coronary angioplasty

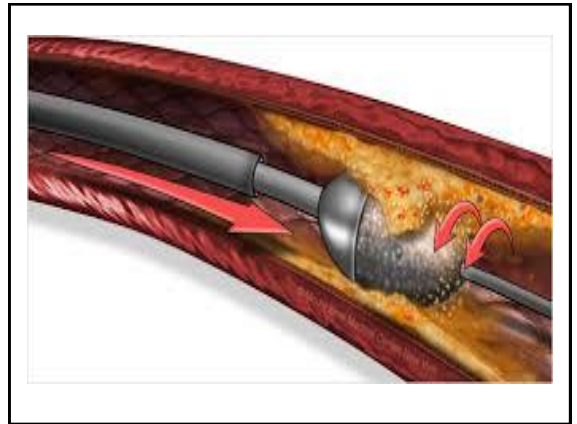


Atherectomy

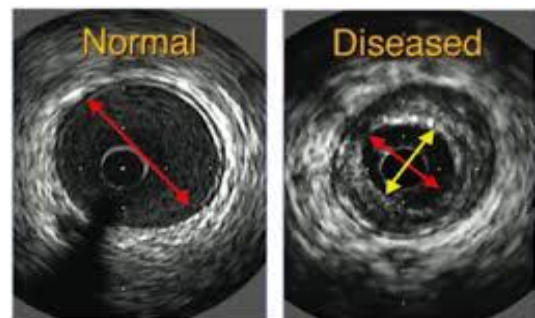
- **Atherectomy** devices remove the fatty deposit or thrombus material within artery
- Directional coronary atherectomy devices having a specialized cutting device to shave out the plaque
- There is a special nose cone that collect the free floating particles

- The tip is a football shape and is embedded with diamond particles
- Special torque guide wire between 160,000-200,000 rpm
- The plaque is pulverized into particles (the size of RBC) and removed by the reticulo-endothelial system

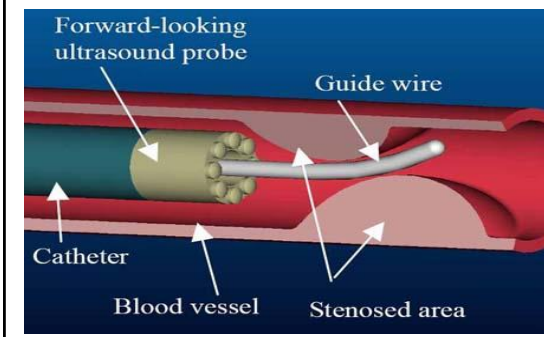
Atherectomy



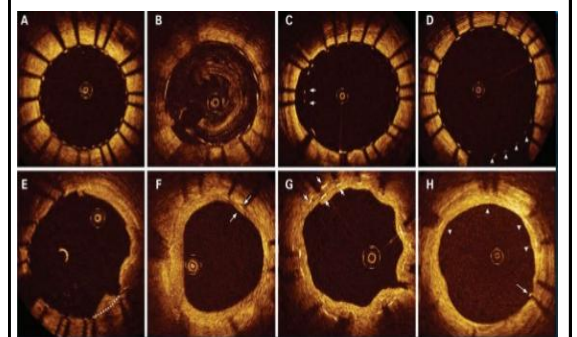
Intravascular Ultrasonography (IVUS)



Intravascular Ultrasonography (IVUS)

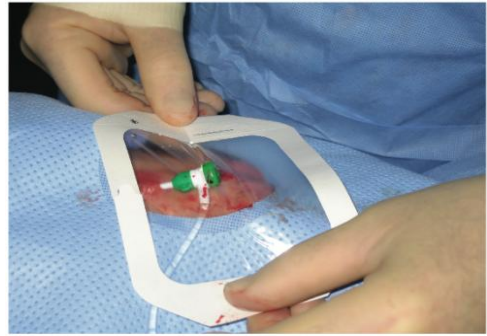


Optical Coherence Tomography



Post-catheterization Care

- Firm pressure is applied to puncture site for 15 - 30 minutes
- Wound sites are cleaned and dressed
- The patient will be observed in recovery for 4-8 hours
- The insertion site will be checked frequently for signs of bleeding
- Medications and discharged instruction are given
- Lots of fluid should be taken
- Vital signs should be monitored for 24 hours



PCI Success

1. Angiographic success

Residual stenosis < 10%, TIMI 3 flow, no occlusion of a significant side-branch, flow-limiting dissection, distal embolization or angiographic thrombus

2. Procedural success

Angiographic success without in-hospital major complications (eg death, MI, stroke, emergent CABG)

3. Clinical success

Procedural success with relief of signs and symptoms of myocardial ischemia

Challenges

- **Restenosis** is the body's response to injury of the vessel wall from angioplasty and stent (foreign body)
- 50% of POBA, suffered significant restenosis
- Stent provide a mechanical framework to hold the artery wall open.
- When stent is used and restenosis occurs, this is called **in-stent restenosis (ISR)**

- Bare-metal stent
- Drug-eluting stent (sirolimus, everolimus, paclitaxel)
- Absorbable/ biodegradable stent

Duration of Antiplatelet

- Double antiplatelet (DAPT) is combination of (aspirin+prasugrel) or (aspirin+ticagrelor) is recommended

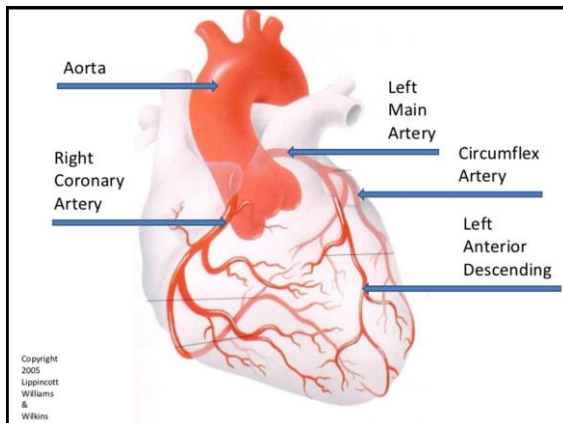
DAPT must be continued for up to **12 months** after STEMI, with strict minimum of:

- **1 month** for patients receiving BMS
- **6months** for patients receiving DES

Limitation of Coronary Intervention

- **Left main stem disease**
- **3- vessel disease**

Coronary Artery Bypass Graft (CABG) is better option



Transradial vs Transfemoral

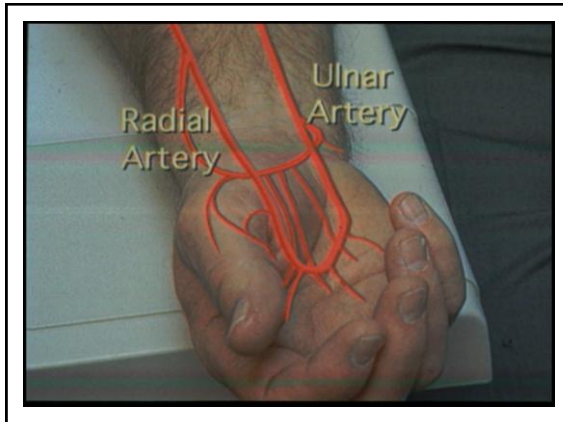
- The actual gold-standard for percutaneous remain femoral access, mainly due to its easy feasibility and short learning curve
- Since its introduction in 1989 for coronary angiography, radial approach has gained progressive widespread in worldwide

1. The radial approach has **lower incidence of local complication**
2. **Avoidance of post-procedural bed-rest**
3. **Improve quality of life**

Transradial vs Transfemoral

- The transradial and transfemoral approach are **equivalent** in terms of major safety with similar rate of MACE
- However, the transradial approach is more **technically demanding** with **global procedural failure of around 7%**

MACE – Major Adverse Cardiac Event

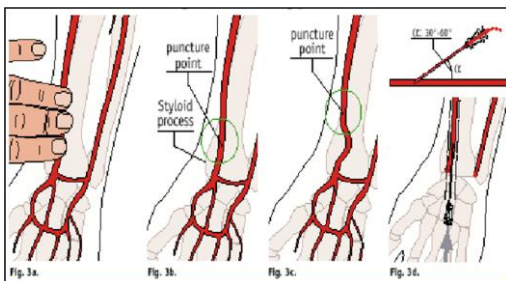


Allen's test – performed \pm Oxymetry test



In the presence of an abnormal Allen's test, the radial artery **should not be used for catheterization**

Radial Access – Proximal to Styloid Process



MOST COMMON ACCESS MISTAKE



Learning Curve

- Getting access
- Radial artery spasm
- Anatomical variation
- Transversing the subclavian
- Catheter shape selection for cannulation
- Catheter control
- Patent hemostasis after pulling out the sheath

Radial Loop and Radial Recurrent Artery



Verapamil Eliminate Spasm Problem



Complication of Transradial Access

- Radial artery occlusion
- Forearm hematoma and pain
- Radial artery pseudoaneurysm
- Radial or brachial artery perforation
- Uncontrolled bleeding with compartment syndrome
- Need for femoral conversion



Femoral Approach

- Puncture site 1-2 cm below inguinal ligament
- Locate inguinal ligament running from anterior superior iliac spine to pubic tubercle
- Use skin crease to mark skin entry
- Fluoroscopy of inferior border of femoral head

Contraindication for Transfemoral Access

- Local skin infection
- Obesity
- Abdominal aortic aneurysm
- Femoral peripheral vascular disease

Complication of Transfemoral Access

- Distal embolization
- Dissection
- Pseudoaneurysm
- Retroperitoneal hematoma



History

In 1929, Werner Forssmann demonstrated that a simple Rubber catheter could be passed to the pulmonary artery through the antecubital vein.



Werner Forssmann

