

Transradial Approach (TRA) to Cardiac Catheterisation and PCI.

1. Advantages

- a. Elimination of access site bleeding complications
- b. Rapid ambulation : Reduced length of stay
- c. Reduced morbidity: patient preference
- d. Reduced morbidity: staff preference
- e. Outpatient procedure option
- f. Lower overall cost
- g. Catheterisation under oral anticoagulation with acceptable bleeding risk

2. Disadvantages

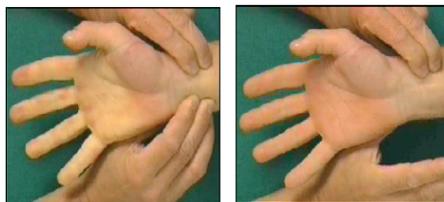
- a. Learning curve
- b. Limits guide catheter size
- c. Possible greater radiation exposure to operator and patient
- d. Long term consequences to radial artery (i.e. for re-access or for use as bypass graft) unknown

3. Practical considerations

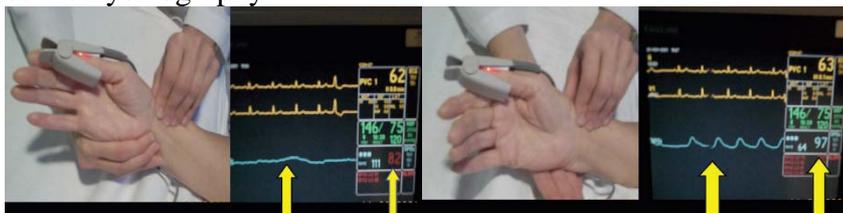
a. Patient setup

i. Perform Allen's test

Allen's Test



or Plethysmography:



- ii. Prep right wrist with patient's arm at his/her side
- iii. Prep femoral artery simultaneously in case of crossover
- iv. Use either a rectangular platform or 2 "banjo" arm boards underneath patient's arm to create a working space distal to patient's right hand



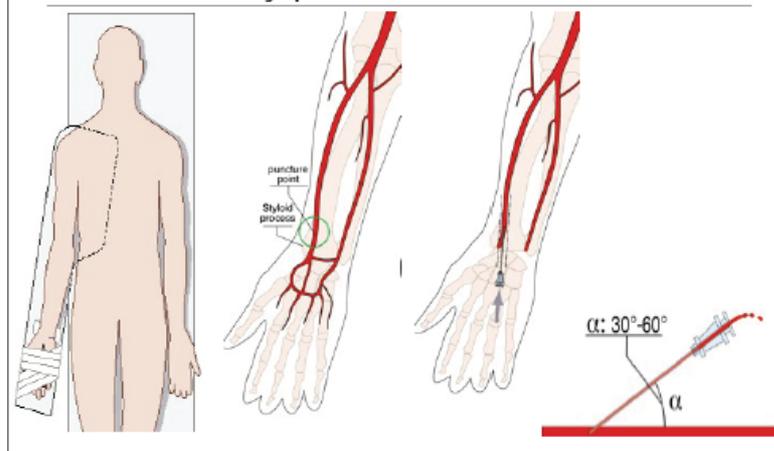
- v. Place towels on working space to elevate working space to level of right wrist or

- vi. in absence of “radial board” as working space, place towels beneath the right wrist to elevate it to level of right thigh, and use patient’s right thigh as working space (similar to that of right femoral approach)
- vii. For left radial cases, elevate left arm using pillows to bring left radial above left groin or have patient bring left arm across body after obtaining left radial artery access



b. Radial artery access

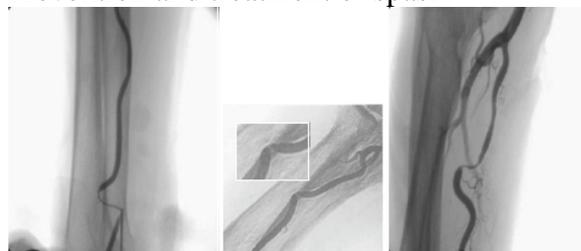
Radial artery puncture



Most common access mistake

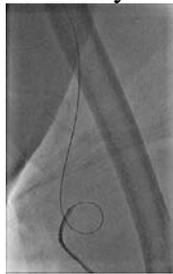


c. Prevention and treatment of spasm



- i. A “Cocktail” of IA GTN +/- IA Verapamil is routinely given before the advancement of a guide wire
- ii. In the case of spasm these cocktails or individual reagents can be repeatedly given
- iii. SC GTN injections or GTN patches
- iv. Patient sedation
- v. Use smaller French size catheters

- d. Repeat access
 - i. Check patency of artery (ultrasonography or reverse Allen test)
 - ii. Obtain access more proximally
- e. Traversing the radiobrachial region
 - i. Radiobrachial angiogram for any resistance to advancing the wire or catheter
 - ii. Radial loop: use 0.014-inch hydrophilic wires to traverse and straighten loop; Use 4F JR4 diagnostic catheter to first traverse radial loop or any tortuosity

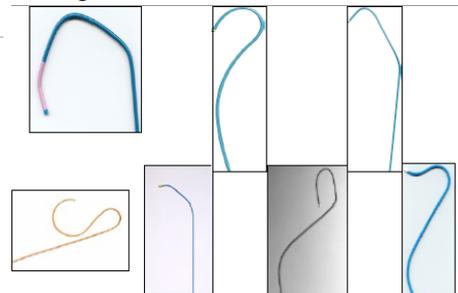


- iii. Consider femoral access bailout if unable to traverse radial loop or if there is significant patient discomfort
- f. Traversing the chest arteries
 - i. Have patient take a deep breath in to straighten subclavian/innominate arteries and subclavian/innominate-aortic junction to direct catheter to ascending aorta
 - ii. For extreme z-curves, use hydrophilic 0.035-inch wires to direct catheters into ascending aorta
- g. Engaging the coronary arteries
 - i. Judkins curves: use longer JR curve (e.g., JR5), shorter JL curve (e.g., JL3.5)
 - ii. Specialized curves (e.g, Tiger, Ikari, Amplatz)

Optimizing back-up support of guiding catheters

1. Insert the guidewire as deeply as possible
2. Choose the most adequate guiding catheter
3. Insert the guiding catheter deeply
4. "Anchoring-balloon" technique
5. "Mother-and-Child" or "5-in-6" guiding catheter technique

Guiding catheters



- h. Previous CABG
 - i. use left wrist with JR4/JL4 catheters, multipurpose catheter, or specialized curves

i. Haemostasis

Hemostatic Devices

- Selective compression of the radial artery to ensure blood return
- Transparent structure to allow visual control
- Optimised patient comfort by precise compression pressure control

The TRI radial band



1. Apply hemostasis device (e.g., HemoBand, RAD-Stat, TR-Band) to wrist
 2. Tighten hemostasis device and remove sheath
 3. Loosen hemostasis device until bleeding occurs, then re-tighten haemostasis device
- If hemostasis is maintained, then leave hemostasis device in place for 2h.

4. Complications

TRA for PCI: Complications 10-year experience at Clinique Pasteur

Hematoma:	<0.5%
Pseudo aneurysm:	<0.1%
AV fistula	<0.1%
Surgical repair	<0.1%
Blood transfusion:	0
Radial artery thrombosis	5%

MIDFOREARM HEMATOMA:
Control with Ace bandage



TRA COMPLICATIONS & MANAGENMENT

ASYMPTOMATIC RADIAL ARTERY OCCLUSION

Adequate anticoagulation with heparin during the procedure (5,000 units of heparin).

Avoid prolonged high-pressure compression, repeat entry, low radial artery to sheath diameter ratio.

Use of compression devices that provide adequate maintenance of perfusion during compression, ie “patent hemostasis,”.

Use of a smaller size introducer sheath and/or guide catheter.

ACUTE RADIAL ARTERIAL OCCLUSION WITH ISCHAEMIA

With intact palmar collateral circulation, hand ischaemia should not occur after transradial catheterization.

- the competence of the palmar dual blood supply has been traditionally evaluated using the Allen's test.

RADIAL ARTERY SPASM

Occurs in 5–10% of all cases, with a higher incidence associated with smaller diameter radial arteries, female gender, multiple catheter exchanges, larger sheath size, and operator inexperience.

The radial artery has a prominent medial layer dominated by alpha-1 adenoreceptor function. Thus, adequate **local anesthesia** and **sedation** to control circulating catecholamine activity can help to prevent arterial spasm. Various vasodilator cocktails, including **nitroglycerin** and/or **calcium-channel blockers**, have been used successfully with immediate effect in preventing spasm. Recent data suggest that subcutaneous administration of 0.5 mg of **dinitrate isosorbide** with 1% lidocaine for local anesthesia may improve radial access. **Hydrophilic coated sheaths** have also been shown to reduce sheath-induced spasm.

ARTERIAL PERFORATION

Radial artery perforation is a rare complication but can lead to severe forearm hematoma if not managed. Although perforation can necessitate conversion to transfemoral access, several case series have demonstrated the safety of continuing the procedure either with the use of a long sheath, guiding catheter, or peripheral balloon to seal the perforation. Furthermore, none of these patients experienced long-term vascular complications.

Compartment syndrome is a rare, but very serious complication requiring emergent fasciotomy, with an incidence reported to be 0.004% in a large series. The diagnosis is based on the symptoms of acute pain and tumefaction with disturbances in distal sensitivity and distal pallor. Since most bleeding is easily managed by simply applying manual pressure, careful observation is critical to identify early warning signs of compartment syndrome. Most perforations are the result of aggressive guidewire manipulation or extensive anticoagulation; as such, it may not be detected during the procedure with temporary tamponade by the catheter shaft. Thus, they often manifest postprocedurally as a forearm hematoma. Angiography of the radial artery when the wire meets resistance can lead to early detection of a perforation. Prompt detection of the hematoma and management with a pressure bandage dressing is the key to preventing unnecessary surgical interventions.

RADIAL ARTERY PSEUDOANEURYSM

Post-TRA cardiac catheterization pseudoaneurysm is a rare complication. It occurs with an incidence of less than 0.1%, as reported in one large case series. It is caused by penetrating injury of the arterial wall during cannulation with resultant hemorrhage and hematoma, and is associated with multiple puncture attempts, catheter infection, aggressive anticoagulation therapy, and the use of larger sheath sizes. Radial artery pseudoaneurysm can present as a pulsatile mass with or without tenderness several days to weeks after the procedure. Diagnosis is made with Doppler ultrasound showing laminar flow entering and exiting at the neck region. Surgical excision of the pseudoaneurysm and/or ligation of the radial artery may be necessary; but successful management with ultrasound-guided compression, percutaneous thrombin injection, and the use of a Terumo TR Band™ have been reported. Early diagnosis and treatment of the false aneurysm is important to minimize any further complications, such as spontaneous rupture or hand ischemia and to maintain sufficient circulation to the hand.

NERVE DAMAGE

There is a paucity of significant neuronal structures near the radial artery. Rarely, digital numbness may occur after TRA catheterization if either the median or radial nerve was injured during repeated punctures. This is usually a benign and minor occurrence, which gradually improves over time. A more serious condition, the Complex Regional Pain Syndrome, is a disorder of the extremities characterized by pain, swelling, range of motion limitation, and vasomotor instability. A few cases of complex regional pain syndrome with or without radial artery occlusion have been reported after TRA catheterization. All reported cases were treated medically, including sympathetic blockage; and the symptoms resolved eventually. Careful examination with prompt and appropriate treatment is important to prevent this potentially disabling condition.

GRANULOMA

Sterile granuloma formation after the use of a hydrophilic-coated radial sheath was initially described in 2003. The pathology showed chronic inflammatory fibrosis with giant cell reaction around a foreign body. The incidence in a single-center series was 2.8% using hydrophilic-coated sheaths and 0% using nonhydrophilic coated sheaths. Patients typically presented 2–3 weeks after the procedure and were initially treated with antibiotics without improvement. Thus far, this phenomenon has only been reported with the hydrophilic-coated sheath manufactured by Cook[®] and not with products made by other companies.

ARTERIO-VEINUS FISTULA

Arteriovenous (AV) fistula is extremely uncommon because the radial artery courses superficially and is surrounded by relatively small veins. It can present as persistent pain and swelling at the puncture site with visibly dilated veins and palpable thrill. Surgical repair may be required to alleviate symptoms.