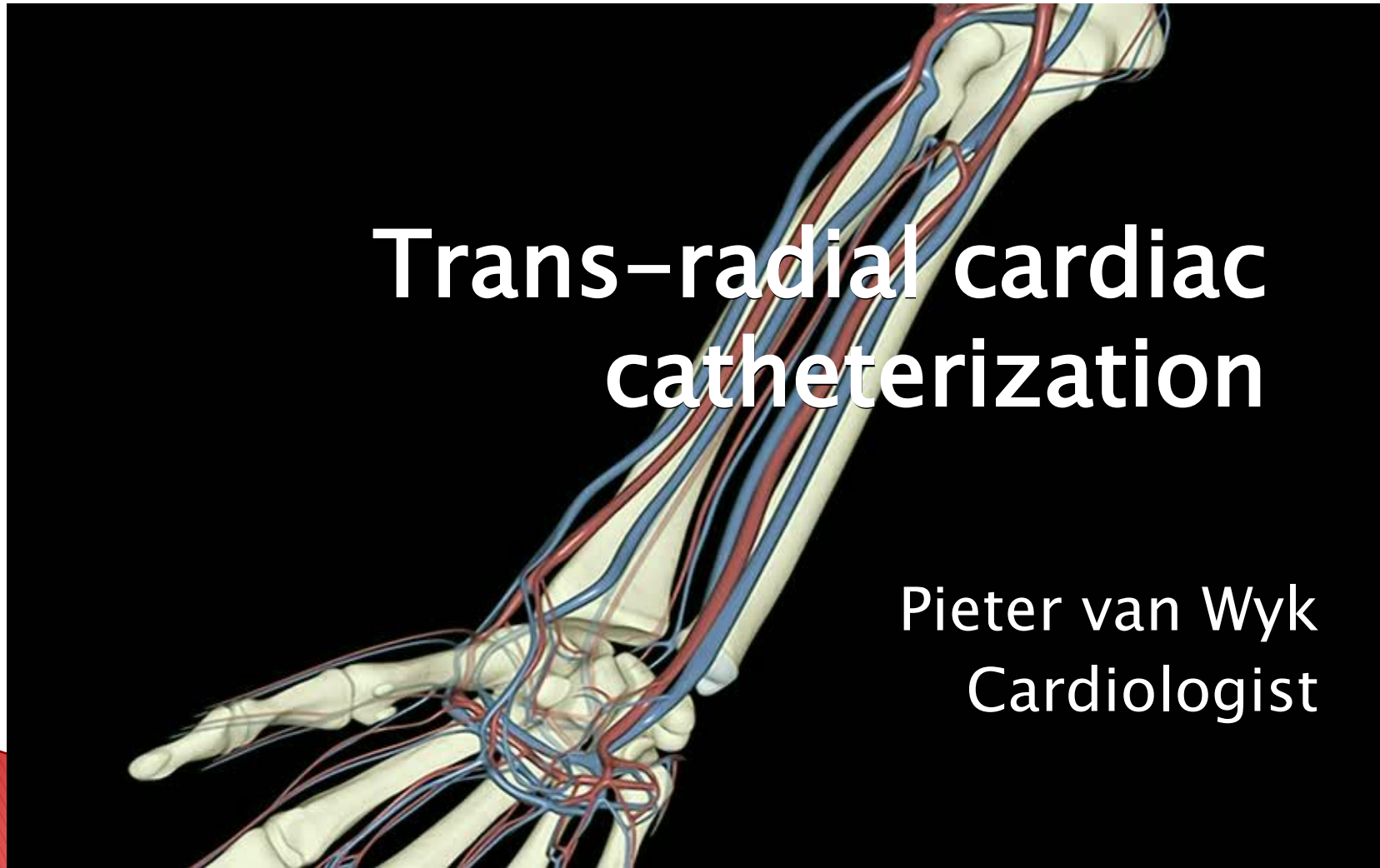
Interventional Society
for CathLab Allied
Professionals

SASCI
South African Society of Cardiovascular Intervention

ISCAP Interventional Society for Cathlab Allied Professionals



Trans-radial cardiac catheterization

Pieter van Wyk
Cardiologist

Presentation Outline

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- History of radial catheterization
- Why trans-radial (TR)
- Literature review
- Indications and contra-indications
- Advantages and disadvantages
- Complications
- Arterial anatomy and variations
- Radial access – preparations and videos
- Tips and tricks – my own spin on radials
- References
- Questions

What makes** an ordinary interventional cardiologist extraordinary is . . . **the ability to create** a dramatic complication and successfully tackling it too **!

Cath lab quotes - Dr .Venkatesan sangareddi, India

History of trans-radial catheterization

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- First cardiac catheterization: 1929 by Werner Forrsman
  - Hypothesized the heart could be catheterized for heamodynamic monitoring and drug delivery. The fear at the time was that such an intrusion into the heart would be fatal.
  - While ignoring his department chief he persuaded an operating-room nurse to assist him. She agreed, but only on the promise that he would do it on her rather than on himself. Forssmann tricked her by restraining her to the operating table whilst actually doing it on himself.
  - He inserted a uretic catheter into his antecubital vein, threading it partly. He then released the nurse and they walked to the X-Ray department and under fluoroscopy he advanced the uretic catheter into his right atrium.
  - 1929-1939: Medical society did not welcome his self-experimentation and he was dismissed from several positions and eventually quit cardiology. He took up urology and excelled in this field.

History of trans-radial catheterization

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- First cardiac catheterization: 1929 by Werner Forrsman
  - 1939-1950: As a member of the Nazi party during WW II, he became a medical officer and rose to the rank of Major, until he was captured and put into a U.S. POW camp. Upon his release in 1945, he worked as a lumberjack and then as a country medic in the Black Forest with his wife. In 1950, he was able to resume practicing urology.
  - In 1956, the Nobel Prize in Physiology or Medicine was awarded to Forßmann.
  - He died on 1 June 1979 from heart failure.
- First trans-radial aortic catheterization: 1948 by S Radner
- First trans-radial coronary angiography: 1989 by Campeau et al
- First trans-radial coronary stenting: 1993 by Kiemeneij and Laarman

Werner Forssman

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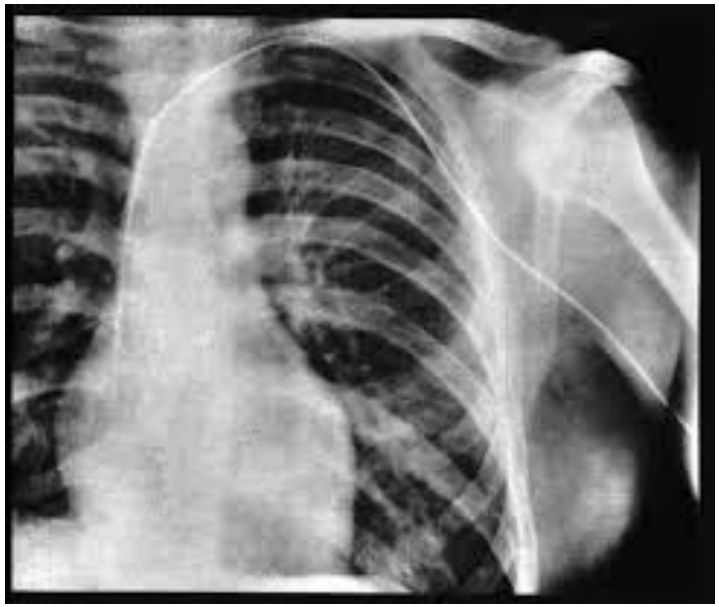

Why the shift from femoral

- Over time there has been an increase in procedural success and declines in ischemic and coronary complications, largely because of advances in antithrombotic therapies, evidence-based pharmacological strategies, and device technology. [1]
- With these successes, recent attention has turned to reducing complications associated with vascular access. [2]
- The search for a procedural approach to bleeding reduction, coupled with the goal of improving patient comfort, has led to a renewed interest in radial artery access.

Literature review

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- What are we aiming for:
  - Procedural success
  - Lower complication rate
  - Improved patient comfort
  - Use less recourses – shorter length of stay and cost reduction

- Literature/evidence to show TR achieves these goals

Literature review – Procedural success

- TR success determined by operator experience:
  - TR = TF PCI success with high volume TR operators
    - Insights from RIVAL trial [3], also observed in several other TR vs TF meta-analysis.
    - Observed in ACS pts [3], stable IHD pts and in complex PCI.
- Risks for TR failure and cross over to TF:
  - Low volume TR operators [3,7]
  - Pts >75yrs [7]

Literature review – Complication rates

- TR associated with reduced access site complications (↓ bleeding & vascular compromise):
  - ACS pts: RIVAL trial [8], MATRIX trial [9]; RIFLE-STE-ACS trial [10], SAFARI-STREMI trial [11].
  - Pts at high bleeding risk: Elderly, on GP IIb/IIIa inhibitors
- This reduction of access site bleeding results in:
  - Reduction in mortality
  - Reduction in blood transfusions
  - Overall reduction in MACE rates.

Literature review – Patient comfort

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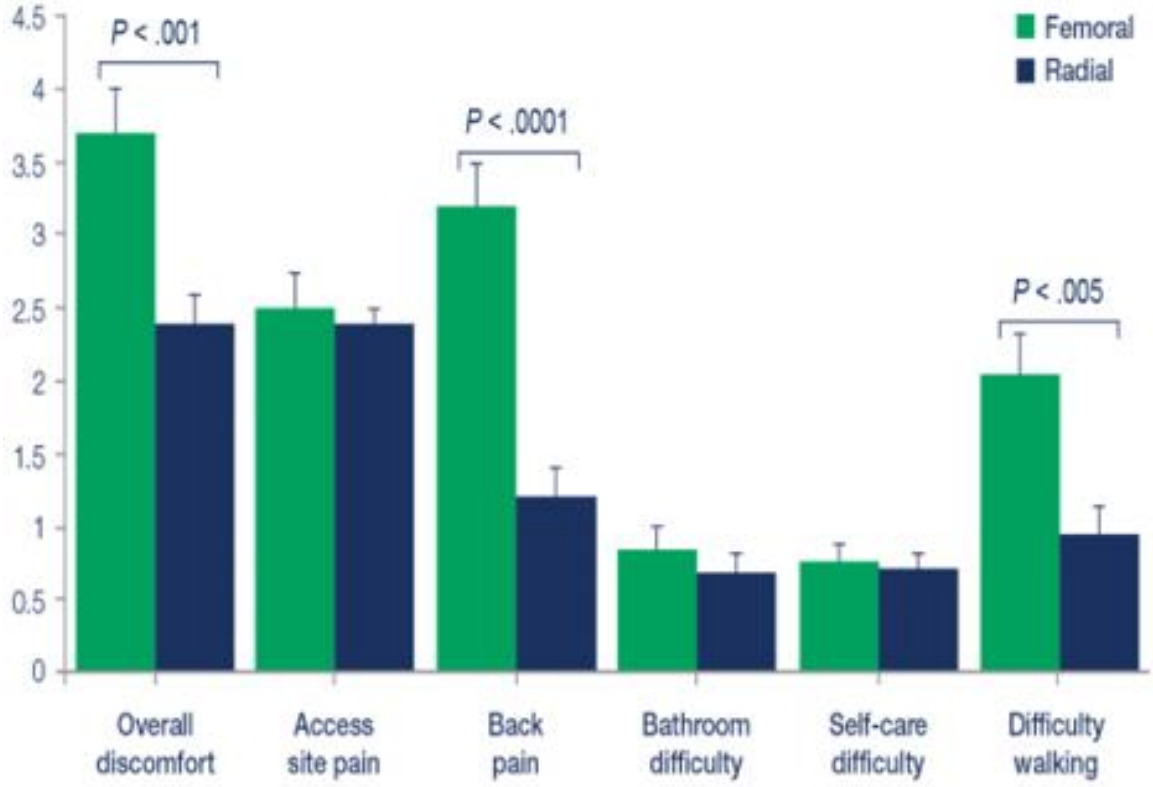
- One of the major advantages of TR over TF access is pt preference and comfort.



Literature review – Resource management

- Significant cost reduction and shortens hospital stay with TR access
  - Some observational studies showed in the US environment ~ 800 USD saved per TR PCI [12]
  - Systematic meta-analysis of RCT showed ~ 275 USD saved per TR PCI [13].
  - Significant reduction in length of hospital stay with TR access of 0.4 to 0.5 days [12,14]

Indications & Contra-indications

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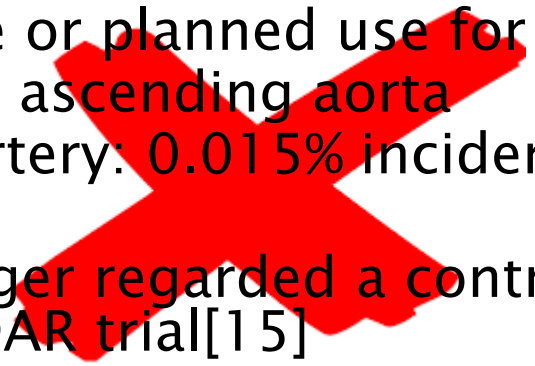
- Indications
  - ACS pts, especially STEMI: Reduces bleeding and access site complications and mortality
  - Pts at high risk of bleeding
  - Stable IHD: When 7+Fr guiding catheters not required
  - Pt preference

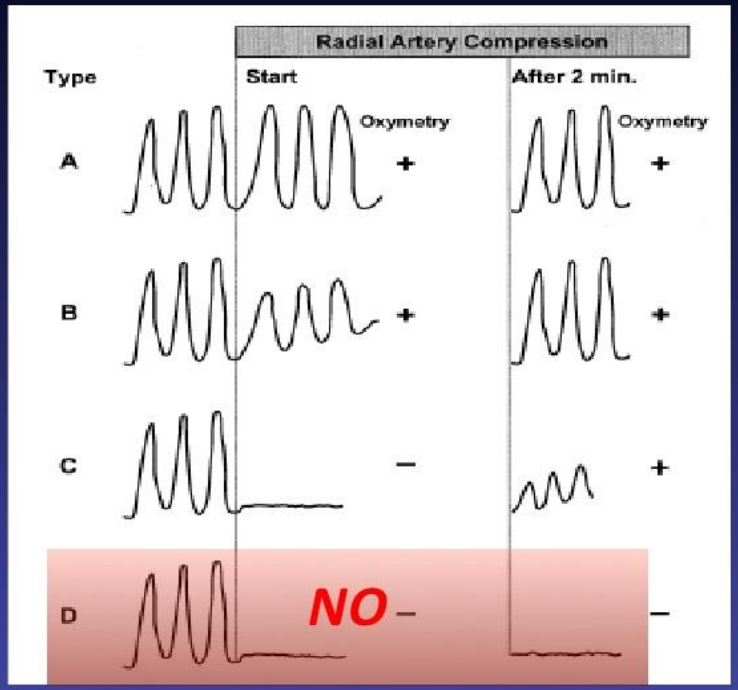
- Contra-indications:
  - Radial artery used for fistulae or planned use for grafting
  - Arterial occlusion on route to ascending aorta
  - Complete absence of ulnar artery: 0.015% incidence



  - Positive Allen's test is no longer regarded a contra-indication for TR access, RADAR trial[15]
  - Barbeau Score = D

Complications: Avoiding hand ischemia

Barbeau score



Barbeau. G et al; Am Heart J 2004;147:489–93

Sheba Medical Center
Tel Hashomer

The Leviev Heart Center

Advantages & disadvantages

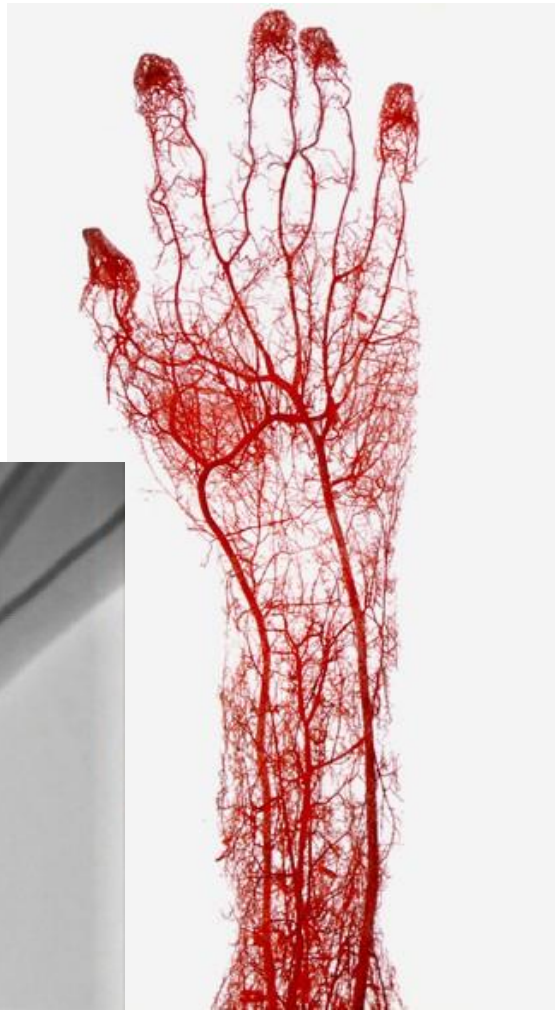
- Advantages of TR:
  - Reduced access site complications, improved patient comfort and preference, shorter hospital stay and cost reduction.
  - Advantages mainly seen in ACS pt, elderly pts or those at higher risk of bleeding after receiving GP IIB/IIIA inhibitors (Reopro).
- Disadvantages:
  - Steep and longer learning curve for operators
  - Increased radiation to operators
  - Guiding catheter size limit ~6.5Fr in females and 7Fr in males

Most important TR advantage

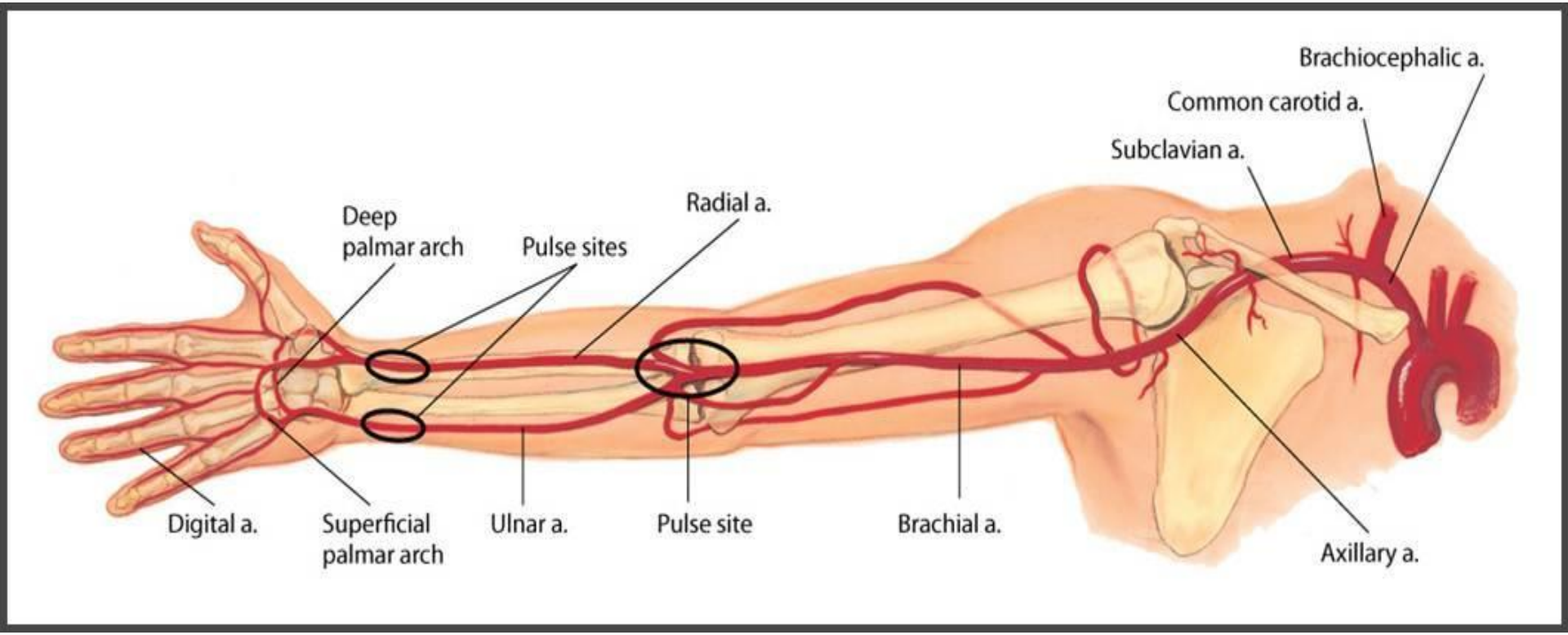
- Nurses do not have to press

Complications

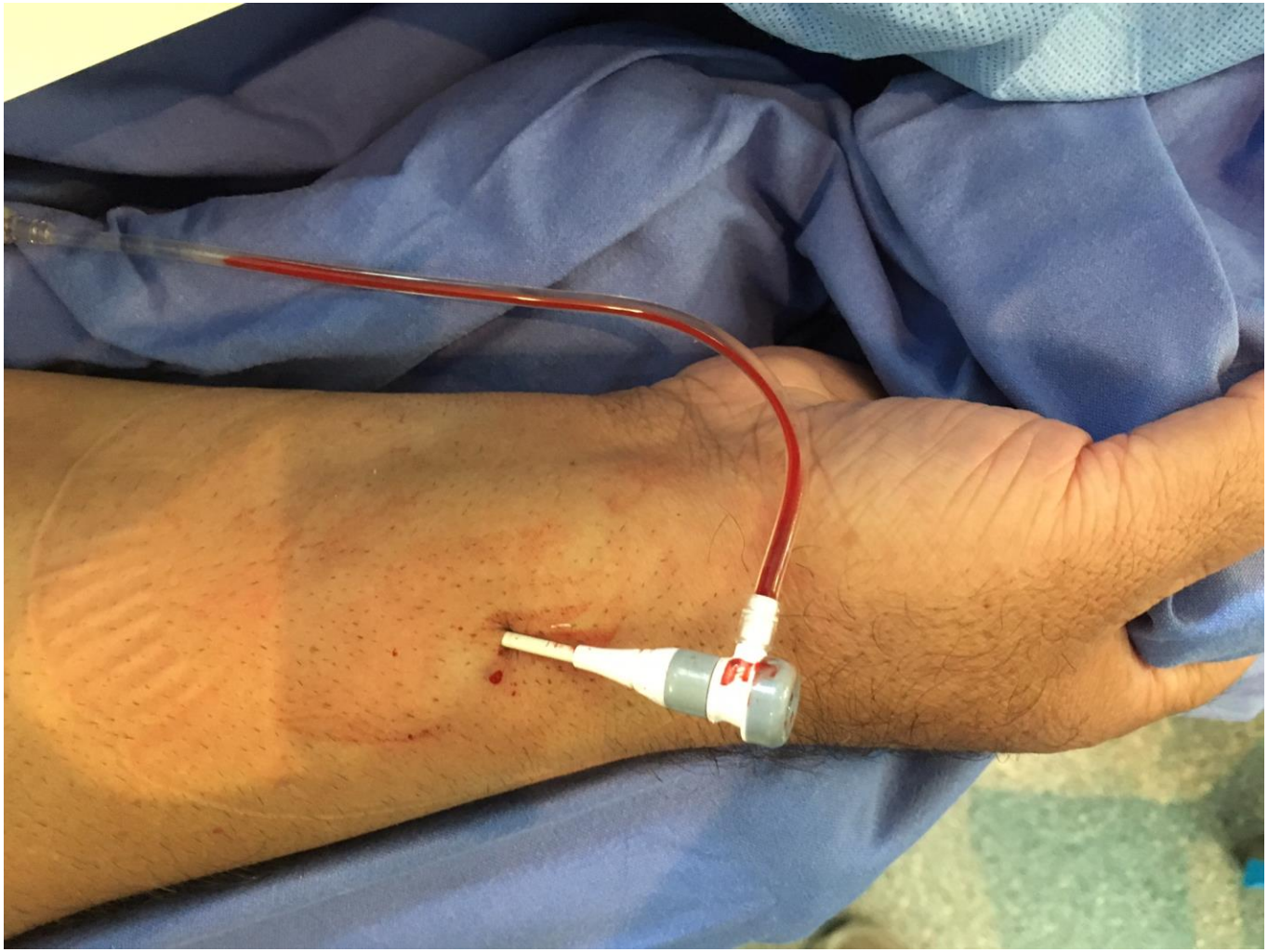
- Hand ischemia requiring intervention: < 1:100000
- Radial artery spasm: ~ 7-14%
  - Experience operators using the right equipment can reduce it to ~3% [16]
- Radial artery occlusion: 5.5% [17]
  - Virtually no clinical consequence to the pt.
- Haematoma
- Compartment syndrome



Normal arterial anatomy

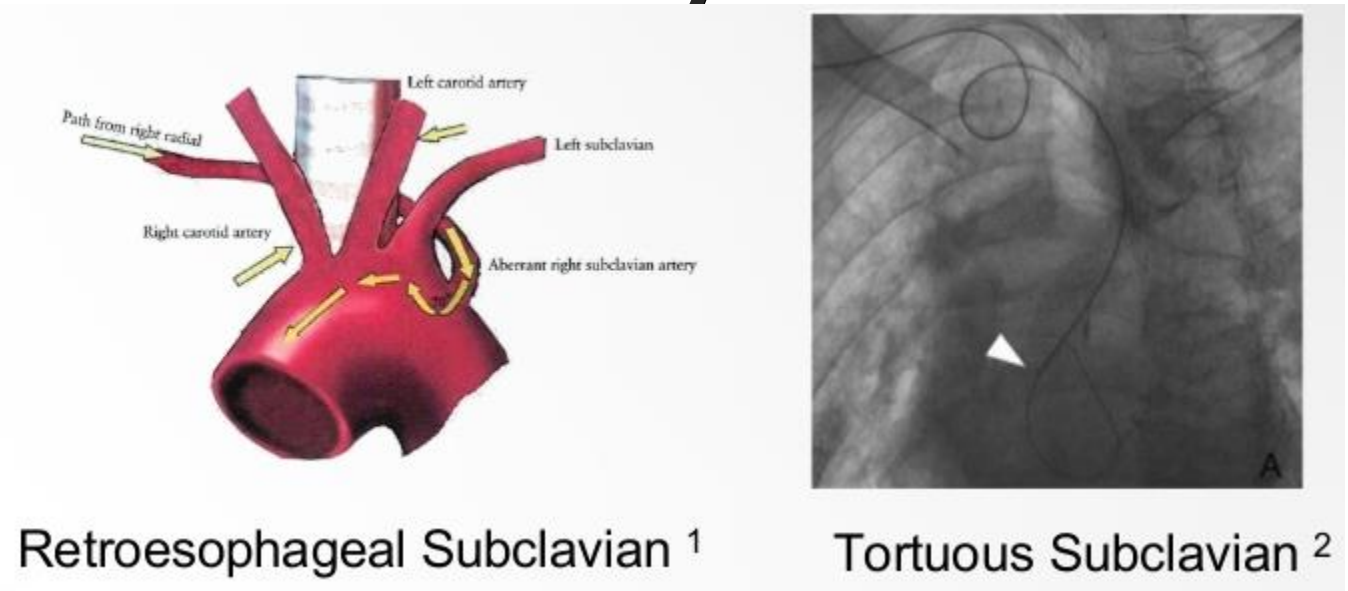


Radial artery variations



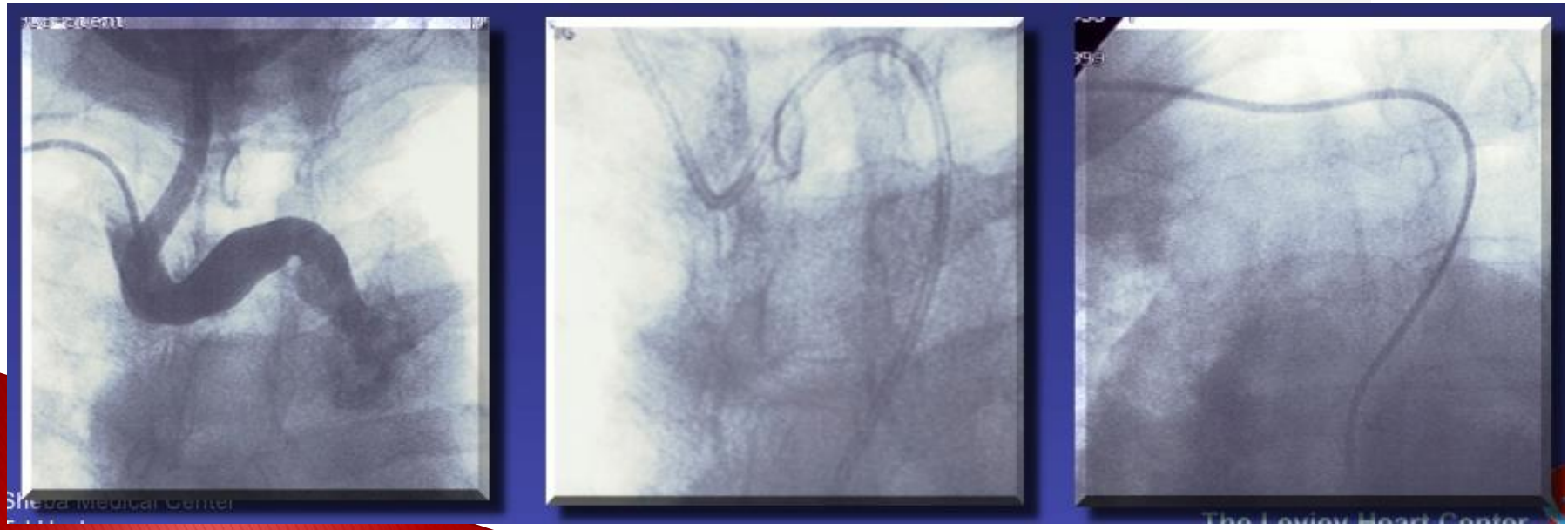
Radial artery variations

Subclavian artery variations



Retroesophageal Subclavian [1]

Tortuous Subclavian [2]



Videos

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- Getting access
- Administering Verapamil
- Removing the sheath

Tips and tricks – my experience

- Problem: Not finding the radial artery with the needle
- Solution:
  - Minimize local anaesthetic volume to 1ml
  - Wait for pulse to be palpable again after local before attempting puncture
  - Do not press hard when feeling for the pulse, this in not the same as femoral pulse
  - Pull needle back slowly if deep, might be through and through
  - Radial artery mostly more medial than I appreciate with palpation
  - Ultra-sound could be used to identify the radial artery

Tips and tricks – my experience

- Problem: Needle in artery, sheath wire not passing out of the needle tip
- NB: DO NOT FORCE A WIRE THAT IS NOT FREE
- Solutions:
  - Manipulate needle:
    - Lower the needle hub to move the needle tip off the arterial wall
    - Rotate the needle may facilitate passing the wire
    - Pass needle through the posterior wall, pull back until blood flash-back return, re-attempt to wire
  - Use a coronary wire, may need to steer wire under fluoroscopic guidance
  - Contrast injection through the needle tip may show arterial course
  - Puncture the radial artery more proximal

Tips and tricks – my experience

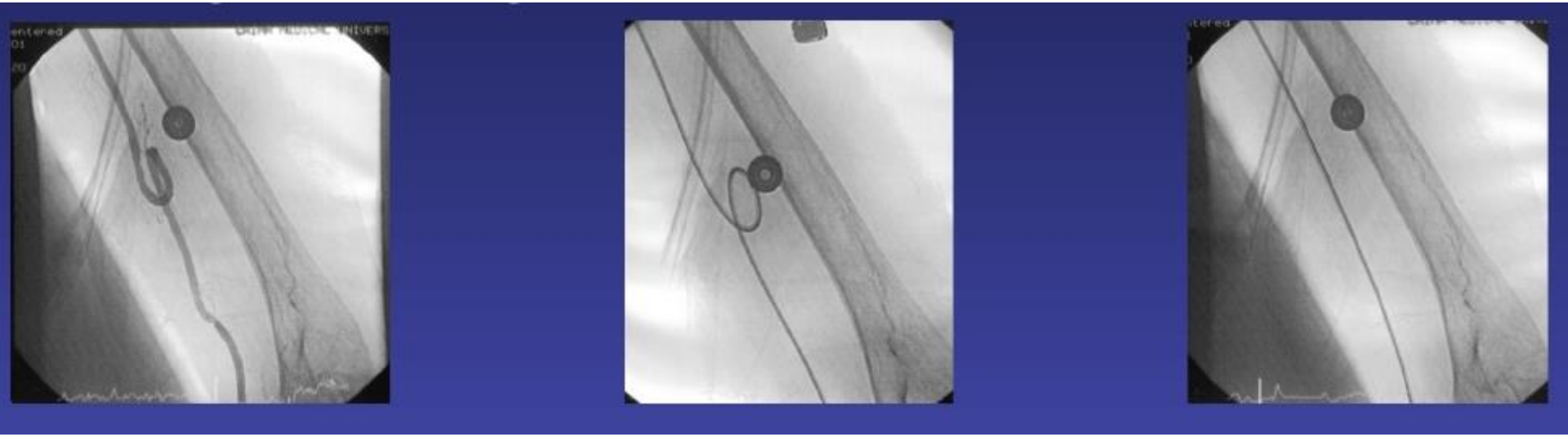
- Problem: Needle in artery, sheath wire not passing freely up the artery
- NB: DO NOT FORCE A WIRE THAT IN NOT FREE
- Solution:
  - If wire went in free 5+ cm beyond needle tip: advance sheath partially then remove dilator and wire and do a contrast injection through the sheath.
  - If wire went in less than 5cm beyond needle tip: Remove sheath wire and attempt with coronary wire, steer wire under fluoroscopic guidance

- When using a coronary wire for sheath insertion:
  - Get coronary wire tip up to shoulder, for support
  - First use sheath dilator, attempt to exchange coronary wire for sheath wire, remove dilator and then insert dilator and sheath as a unit like normal.

Tips and tricks – my experience

- Problem: Sheath inserted, J-wire not advancing beyond elbow
- Solution:
  - Advance wire under fluoroscopy
  - Advance catheter to mid forearm, remove J-wire and inject contrast to evaluate arterial course
  - May require a coated wire (Glidewire) or coronary wire to navigate into brachial artery.
  - For radial loops: advance the wire beyond the loop, ask an assistant to compress over brachial artery (external anchor of the wire), then pull on wire at wrist to straighten the loop then advance the catheter.

Tips and tricks – my experience



Tips and tricks – my experience

- Problem: Unable to advance J-wire / catheter from subclavian into ascending aorta (torturous innominate artery)
- Solution:
  - Ask pt to take a deep breath and hold, this straightens the route.
  - Change for JR catheter, easier to manipulate and direct in this position
  - If wire goes to descending aorta, follow with the catheter, deep inspiration and withdraw wire and catheter, often will fall into ascending aorta.
  - Low threshold to do contrast injection and detail anatomical course (RAO and LAO views best)
  - Can use a coronary wire as well as coated wire to facilitate passing the catheter to ascending aorta.

Tips and tricks – my experience

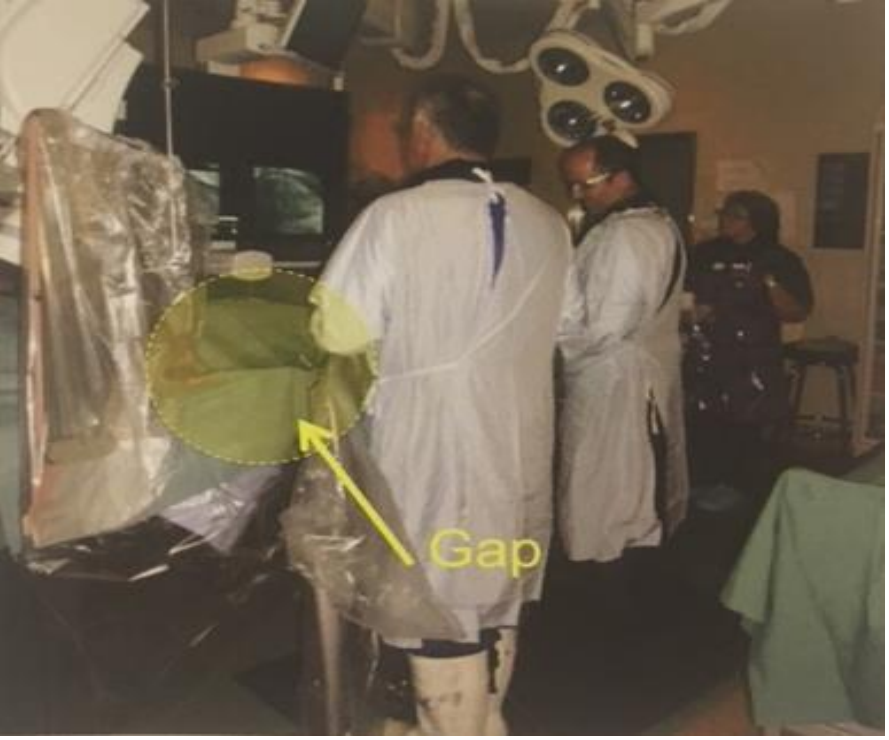
- Problem: Radial artery spasm
- Solution: Prevention:
  - Do not force / push a wire in the arm that is not free.
  - Sedation [19]
  - Subcutaneous nitrate may help
  - Don't oversize the sheath for the artery
  - Use hydrophilic radial sheaths [16]
  - Intra-arterial vasodilators [16]:
    - Verapamil / Nitrate
  - Prevent over-manipulation of catheters

Tips and tricks – my experience

- Problem: Radial artery spasm
- Solution: Treatment:
  - Time is the most effective cure
  - Withdraw catheter tip to mid brachial artery, remove wire then administer vasodilators, re-insert the wire and withdraw the catheter.
  - Administer vasodilators via sheath side-port
  - Analgesia and sedation
  - Use smaller catheters
  - Use hydrophilic coated sheath-less guides:
    - Has a dilator tip
    - FANTASTIC trick
  - Soft balloon inflation in radial to relieve spasm

Tips and tricks – my experience

- Problem: To much radiation
- Solution:
  - Full body lead: Hat, glasses, thyroid, jacket, skirt and shin-guards.
  - Bring shield as close to operator as possible
  - Proactive about radiation reduction: Radiographers!!
    - Step back when acquiring diagnostic images
    - Go to low frame rate when possible
    - Culumate when possible
  - Abdominal lead drape



Results

- Measurements have shown that use of the shielding can reduce scattered radiation reaching the cardiologist.
- Once in place, the shielding can be left for the duration of the procedure.
- Film badge results (Fig. 1, 2) for Cardiology Department show a decrease in staff doses of 33 – 43% since implementing the shielding.

(Results are independent of an individual's varying workload as the department is assessed as a whole. The total number of staff remained constant and work has increased overall yet still yielding a reduction in radiation doses).

Figure 2: Summary of average monthly thyroid shield doses before and after implementing patient shielding.

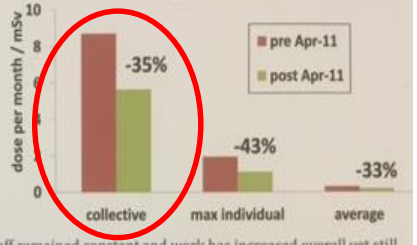
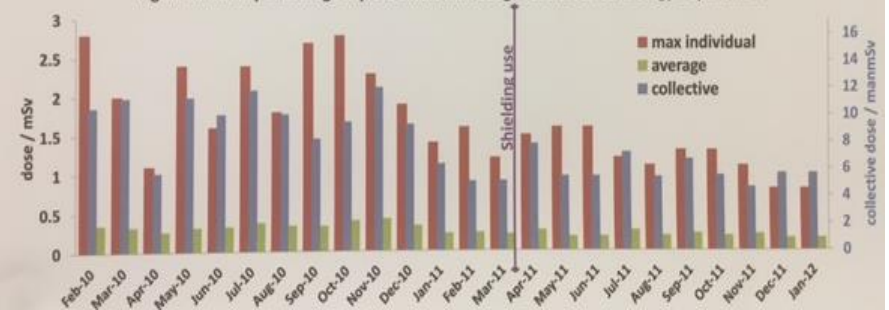


Figure 1: History of average thyroid shield film badge results for Cardiology Department



0.5mm lead

51% radiation doses reduction

Take home messages

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- Important for TF operators to upskill to TR access:
  - In ACS pts TR reduces mortality by reducing access site bleeding complications
  - In all pts it improves comfort, shortens hospital admission duration and reduce cost.
- Important for TR operators to upskill in TF access:
  - Bailout if TR unsuccessful
  - Required for complex PCI where ~ 7+Fr guides needed
  - Ultrasound guided TF access may even the score
- When not to start with TR access:
  - Contra-indication to TR access: Anatomical reason or radial artery saved/used for other purpose.
  - Procedure planned requires ~ 7+guiding catheter

AN INTERVIEW WITH JAMES C. BLANKENSHIP, MD · MITRAL VALVE UPDATE

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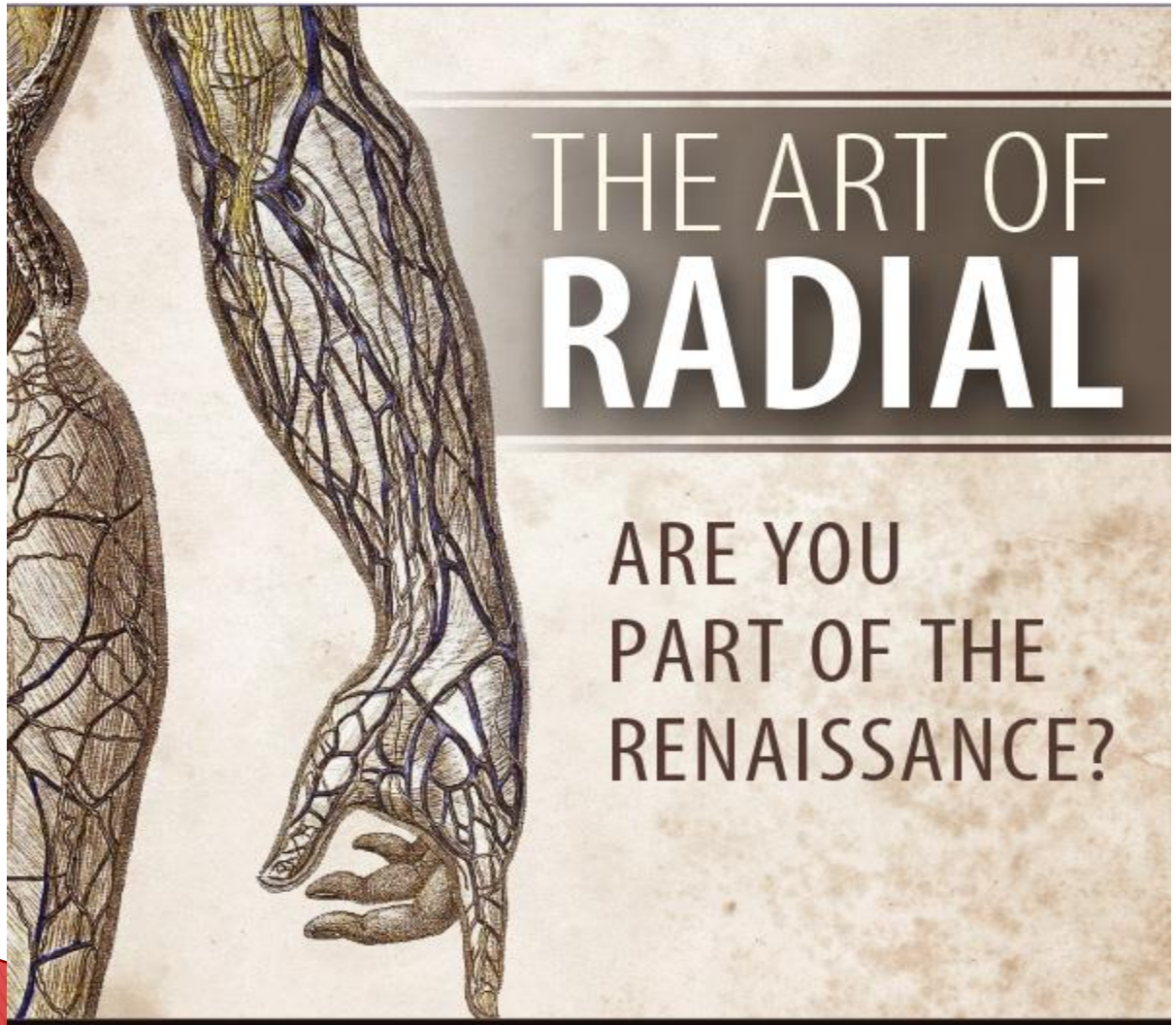

THE ART OF RADIAL

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Questions

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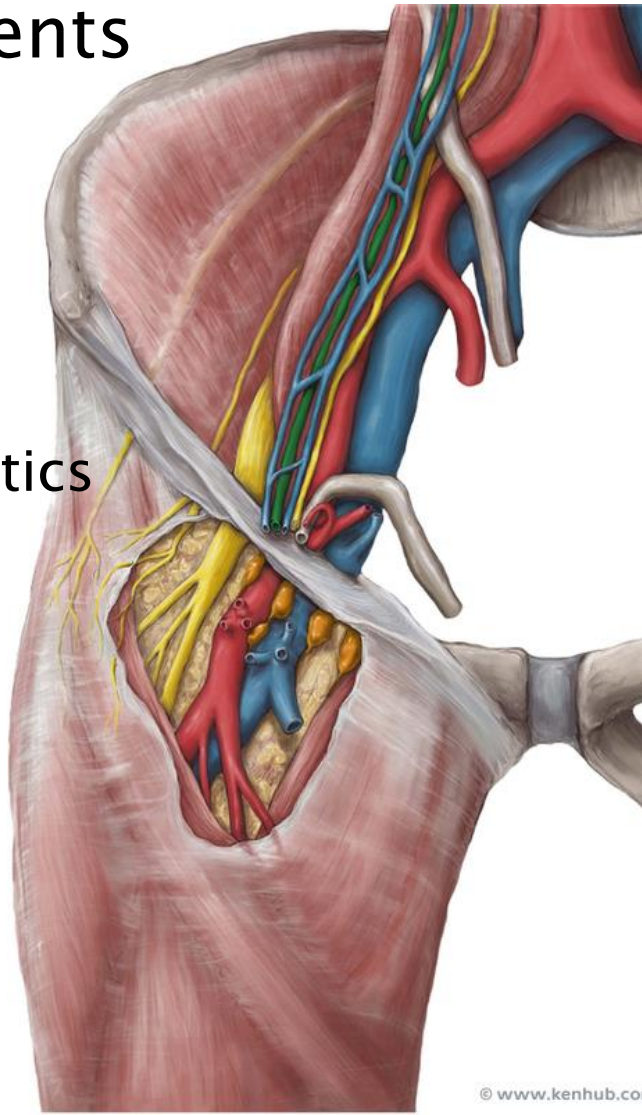
Limitations of Femoral Access

- Deep – especially in obese patients
  - Access and Compression
- Proximity to vein and nerve
  - Injury / pain
- Bleeding complications
  - IIbIIIa inhibitors, heparin, thrombolytics
  - Despite numerous closure devices
  - Bleeding is concealed
- End artery
- Need for prolonged bed rest



Radial Artery

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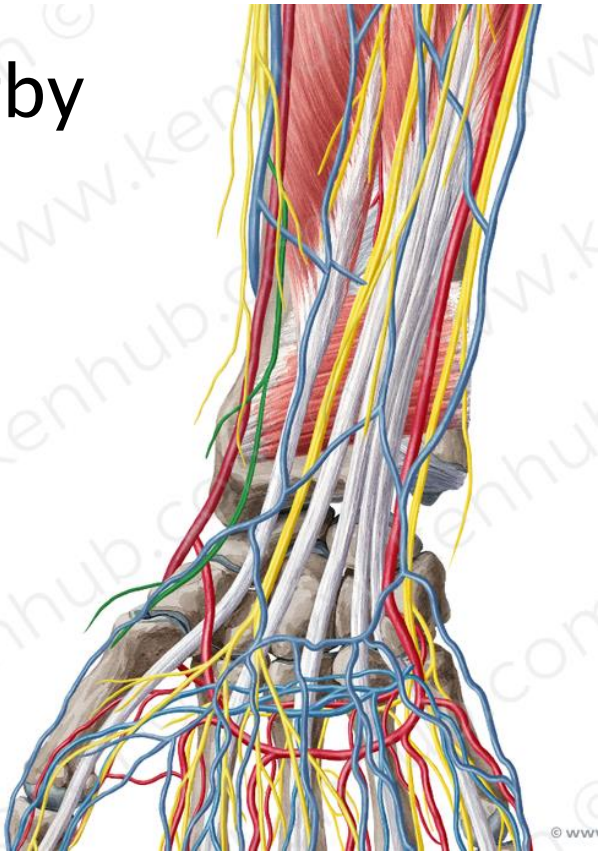
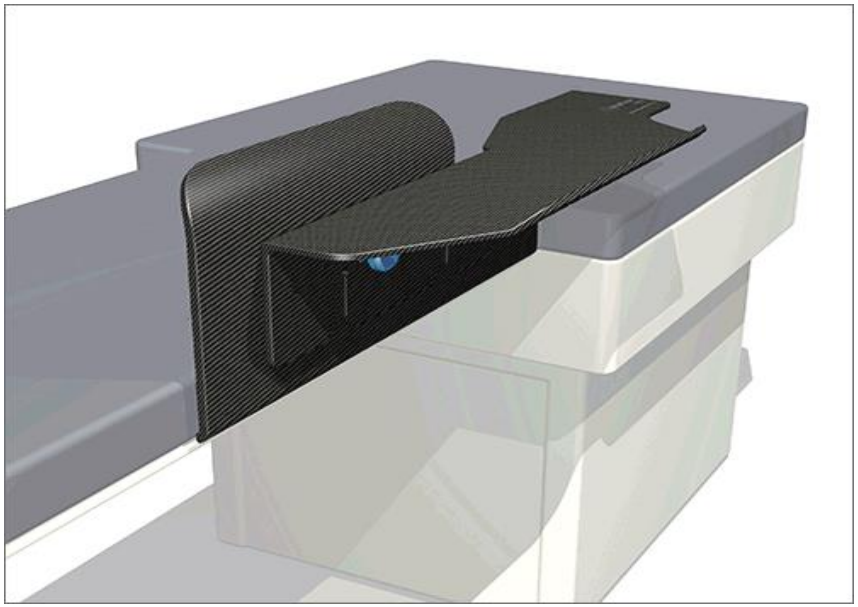
- Superficial
  - Therefore major bleeding is very rare
    - Bleeding is immediately evident
    - Patient can control bleeding
- No nerves or major veins nearby
- Not an end-artery
- Immediate mobilization
  - Outpatient PCI

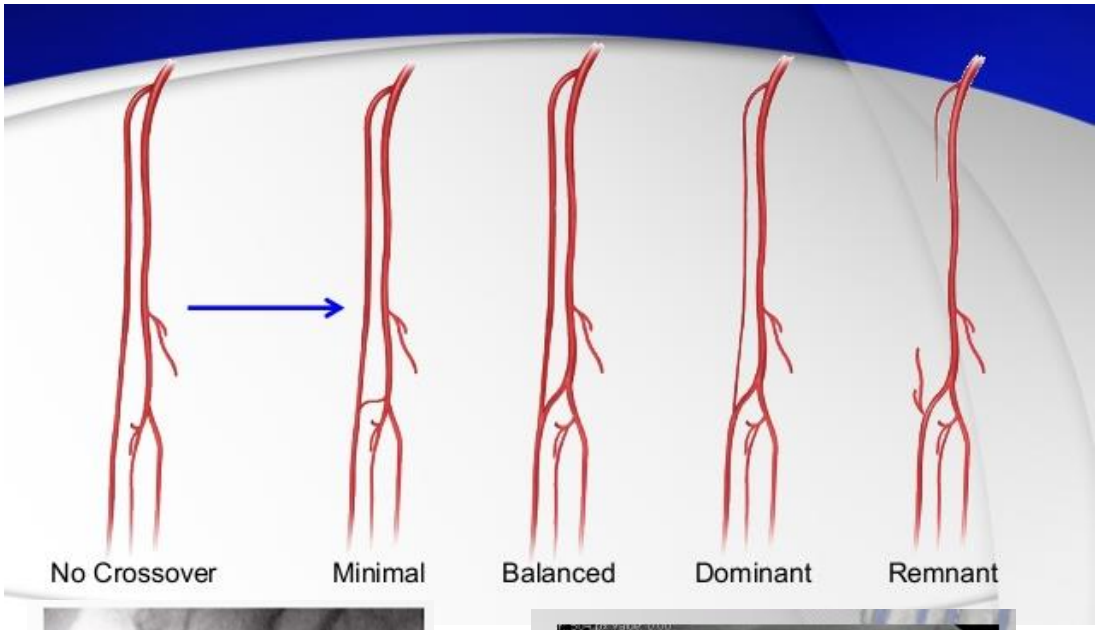


Preparation and setup for TR

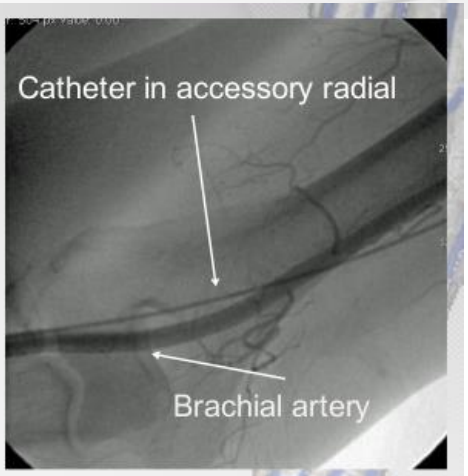
- Prepare both radial and femoral sites
- Spray xylocaine on wrist
- Elevate the wrist
- Fix the hand in hyperextension
- Standard drape over wrist



Radial artery variations



Radial Loop
(2.3%)



High Radial Origins
(7.0%)

Aortic arch variations

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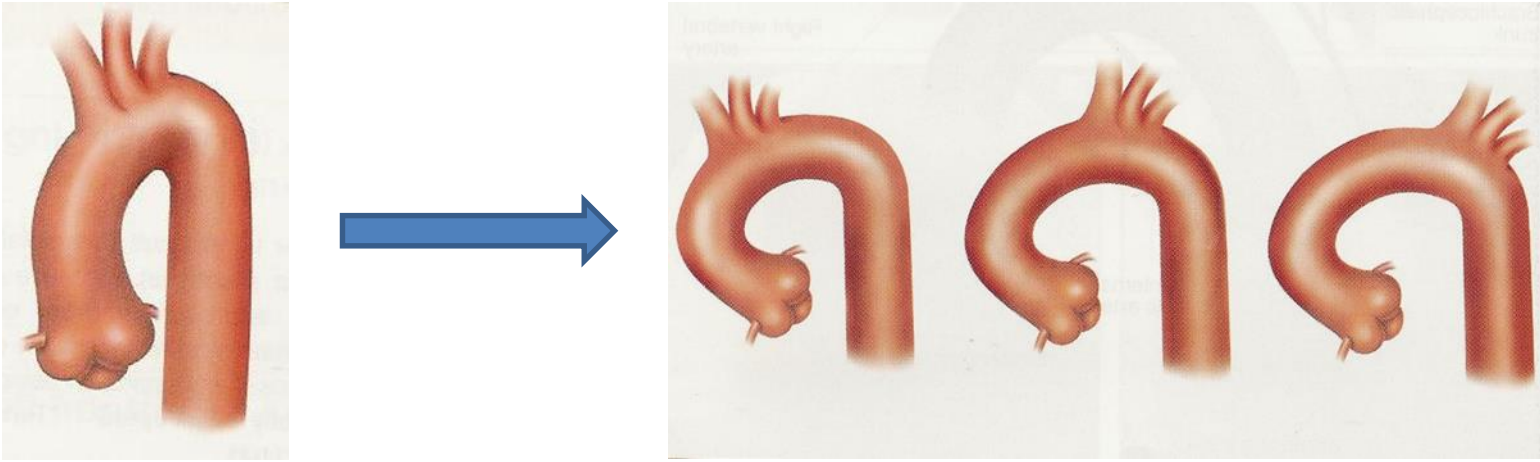


Tips and tricks

- Problem: Radial artery occlusion (RAO)
- Solution:
  - Use of heparin at start of procedure, lower doses of heparin were associated with increased RAO [17]
  - Shorter compression times also reduced RAO [17]
  - Ulnar artery compression, PROPHET II trial [18]

Tips and tricks

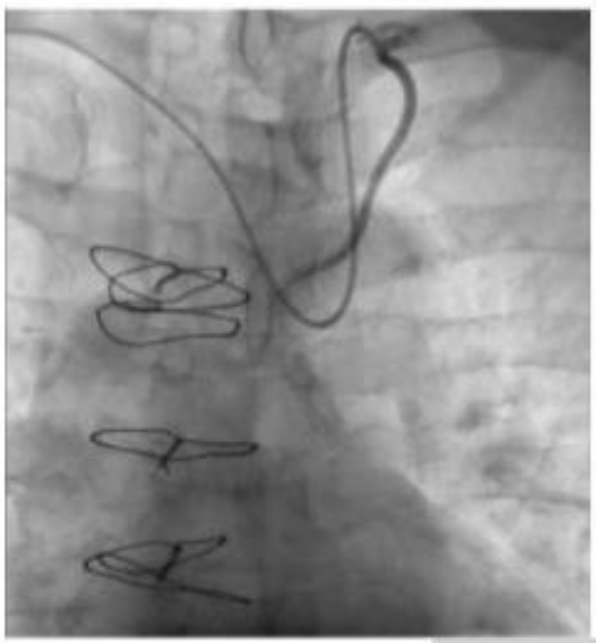
- Problem: Engaging coronaries / grafts
- Solution:
  - RCA: JR4 (90%+ success), LCB catheter very useful as next, then AL1/0.75.
  - LMS: Diagnostic: JL3.5 (90%+ success), JL4/5, then go for a guide.
    Guide: Don't down-size, you need the support
    EBU3.5/3.75 works well
  - Vein grafts: From LRA => AL1; From RRA => as TF
  - LIMA: Diagnostic: BC catheter

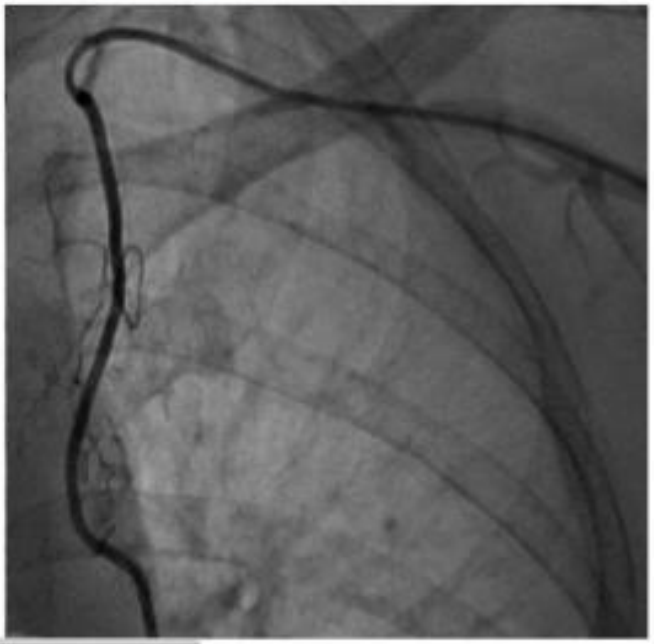
  - ALWAYS USE ECXHANGE LENGHT WIRE

University of Illinois at Chicago Jesse Brown VA Medical Center

LIMA

Bartorelli-Cozzi Catheter





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