بسم الله الرحمن الرحيم
Transradial Access and intervention: Step-by-step

Gamal Fahim, MD, FSCAI

Cardiology Department  Mansura university

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ggomaa.blogspot.com
Case scenario
Clinical data

- Male, E M
- 52 Years
- DM
- New-onset severe prolonged typical chest pain
- New Resting ST T wave changes in chest leads; Wellen`s syndrome
Clinical data

- Echo: no RSWMA, normal EF
- Coronary angio
  - Right radial
  - Trumo set
  - JR 3.5, JL 3.5 6F
Anatomy of major epicardial coronaries
Diagnosis

52 y, M, Diabetic

High-risk ACS

Normal LV systolic function

Angiography:

– Tight long subtotal mid LAD
– LCX: Dominant, small vessel disease
– RCA: non dominant, small diffuse disease
Decision

PCI and stenting of LAD:

Approach: Right radial

Guiding: EBU 3.5 6 F

PTCA Wire: Runthrough Floppy

STENT: DES promus element 3 38

Post tenting optimization: NC 3.5 15
NC 3.5 15
Final result

Baseline

Final result
CLINICAL COURSE

• Angiographic success
• TR band and removal of sheath on table
• Pain free
• Stable hemodynamics
• Electrically stable
• Discharged at 6 hours
TRI: Step by Step

1. Introduction & Positioning the patient
2. Right vs. left radial access
3. Choice of equipment
4. Arterial puncture technique
5. Understanding and navigating the upper extremity vasculature
6. Coronary engagement – Catheter selection for diagnostic angiography and PCI
7. Hemostasis
Prevalence of TRA By Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yemen</td>
<td>0.3%</td>
</tr>
<tr>
<td>Republic of Macedonia</td>
<td>0.3%</td>
</tr>
<tr>
<td>Jordan</td>
<td>0.3%</td>
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<tr>
<td>Jordan (Islamic Republic of)</td>
<td>0.3%</td>
</tr>
<tr>
<td>Greece</td>
<td>0.3%</td>
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<tr>
<td>Croatia</td>
<td>0.3%</td>
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<tr>
<td>Albania</td>
<td>0.3%</td>
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<tr>
<td>Afghanistan</td>
<td>0.3%</td>
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<tr>
<td>Thailand</td>
<td>0.2%</td>
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<tr>
<td>Taiwan</td>
<td>0.2%</td>
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<tr>
<td>Puerto Rico</td>
<td>0.2%</td>
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<tr>
<td>Lebanon</td>
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<tr>
<td>Ireland</td>
<td>0.2%</td>
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<tr>
<td>Finland</td>
<td>0.2%</td>
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<tr>
<td>Dominican Republic</td>
<td>0.2%</td>
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<tr>
<td>Viet Nam</td>
<td>0.1%</td>
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<tr>
<td>Uruguay</td>
<td>0.1%</td>
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<tr>
<td>Sri Lanka</td>
<td>0.1%</td>
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<tr>
<td>Romania</td>
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<td>Qatar</td>
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<td>Peru</td>
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<td>Panama</td>
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<td>Nicaragua</td>
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<td>Malta</td>
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<tr>
<td>Malaysia</td>
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<tr>
<td>Luxembourg</td>
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<tr>
<td>Libyan Arab Jamahiriya</td>
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<tr>
<td>Kuwait</td>
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<tr>
<td>Kazakhstan</td>
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<td>Jamaica</td>
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<tr>
<td>Egypt</td>
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<tr>
<td>North Korea (DPRK)</td>
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<tr>
<td>Belarus</td>
<td>0.1%</td>
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<tr>
<td>Bangladesh</td>
<td>0.1%</td>
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<tr>
<td>Bahamas</td>
<td>0.1%</td>
</tr>
<tr>
<td>Austria</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

N = 1107 Physicians Surveyed in 75 Countries
Transradial Use for STEMI in the US

Figure 3  Temporal Trend in Use of TRI for STEMI PCI from 2007 to 2011

When not to consider radial access

- Can be done by experienced operators:
  - Bilateral IMA grafts
  - Devices requiring large-bore guide catheters

- Just don’t do it:
  - Patient refuses
  - Dialysis grafts
  - Raynaud’s, Buerger’s disease, Scleroderma, Ipsilateral mastectomy
  - If you are an untrained operator!!

1 Can be done by experienced radialists
2 Some data suggesting this is safe
Arm is very well collateralized

- No correlation to hand ischemia & arterial lines\(^1\)
- Extensive radial CABG experience without ischemia
- Radial harvest with abnormal Allen’s Test is possible\(^2\)

Theoretical fears from an abnormal Allen’s Test is a poor excuse for a real risk of groin complications

1. J Trauma 2006;206:468-70
Basic Rules
Radial is Different than Femoral

- Precise puncture & never push (finesse over muscle)
- Prophylactic antispasm medication is needed
  - Verapamil 3 mg / NTG
- Anticoagulate to prevent (reduce) thrombosis
  - Heparin 5000 U (~50 U/Kg in lighter patients)
- Hold on to hard won territory (exchange wire or jet-catheter exchange technique)
- Find a catheter series that works for you (practice makes perfect)
- Remove the sheath at the end of the case
The pulse oxymeter is placed on the thumb and the wrist is hyper extended using a towel.
TRI: Step by Step

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TALENT TRIAL: Right vs. Left Radial
Operator’s experience matters

- Fellow: 
P = .001
- Senior: 
P = .11

- Fluoroscopy time
  - RRA (n=487)
  - LRA (n=476)

- Dose Area Product (Fluoroscopy)
  - RRA (n=245)
  - LRA (n=257)

(Sciahbasi A et al. Am Heart J 2011;161:172-9)
TRI: Step by Step

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Sheath Selection

Pts Undergoing Cath or PCI via the Radial Artery

2x2 Factorial Randomization

- Long (23 cm) n=396
- Short (13 cm) n=394
- Coated n=397
- Uncoated n=393

<table>
<thead>
<tr>
<th>Operator RAS</th>
<th>Long (23 cm)</th>
<th>Short (13 cm)</th>
<th>Coated</th>
<th>Uncoated</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 (27.9%)</td>
<td>120 (30.8%)*</td>
<td>75 (19.0%)</td>
<td>155 (39.9%)^</td>
<td></td>
</tr>
<tr>
<td>85 (21.5%)</td>
<td>87 (22.2%)*</td>
<td>60 (15.1%)</td>
<td>112 (28.5%)^</td>
<td></td>
</tr>
</tbody>
</table>

* p=NS
^ p<0.001

Young age, female sex, diabetes, and low BMI to be independent predictors of RAS

Rathore S et al. JACC Interv, 2010; 3:475-482
Tapered transition between sheath and wire makes skin nick unnecessary.
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Access Techniques

- Right or left?
- Access the radial artery ≥ 2 cm proximal to the radial styloid process
- Avoid access over the flexor retinaculum
- Back-wall puncture technique
  - Seldinger method
  - Micropuncture IV catheter (fine metal needle and a 22G Teflon catheter) → “Angiocath”
- Single wall technique
  - Short 2.5 cm stainless steel 21G needle
- Both allow the passage of a 0.018”-0.021” guidewire
Radial Artery Access Technique Evaluation Trial

Radial Catheterization

R

Seldinger (n=210)

Modified Seldinger (n=202)

Procedural Characteristics
Complications

Two operators
5F hydrophylic-coated sheaths
Vasodilators: Diltiazem 5 mg + NTG 200 mcg

Anticoagulation: 50 U/Kg UFH
Hemostasis: TR Band applied for 2 hs

Pancholy et al. CCI 2012
<table>
<thead>
<tr>
<th></th>
<th>Seldinger Technique (n=210)</th>
<th>Modified Seldinger Technique (n=202)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Time (min)</td>
<td>78.3±37.7</td>
<td>134.2±87.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Procedure time (min)</td>
<td>17.1±6.4</td>
<td>19.3±7.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Number of attempts</td>
<td>1.7±0.8</td>
<td>2.2±0.8</td>
<td>&lt;0.001</td>
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<tr>
<td>First Attempt Access</td>
<td>53%</td>
<td>16%</td>
<td>&lt;0.001</td>
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<tr>
<td>Crossover</td>
<td>0</td>
<td>10.8%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
TRI: Step by Step

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Understanding the Catheter’s Course

Right Radial
- 2 points of resistance

Left Radial
- 1 point of resistance

Femoral
- 1 point of resistance
## TRA: Mechanisms of Failure

<table>
<thead>
<tr>
<th>Failure &amp; Description</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Total number of Failures</td>
<td>98/2100 (4.6%)</td>
</tr>
<tr>
<td>Failure of arterial access</td>
<td></td>
</tr>
<tr>
<td>Inadequate arterial puncture</td>
<td>13%</td>
</tr>
<tr>
<td>Failure to advance catheter to ascending aorta</td>
<td></td>
</tr>
<tr>
<td>Radial artery, HYDROPHYLIC SHEATHS NOT USED</td>
<td>34%</td>
</tr>
<tr>
<td>Radial artery dissection</td>
<td>10%</td>
</tr>
<tr>
<td>Radial artery loop/tortuosity</td>
<td>6%</td>
</tr>
<tr>
<td>Radial artery stenosis</td>
<td>1%</td>
</tr>
<tr>
<td>Failure to complete PCI due to lack of guide support</td>
<td></td>
</tr>
<tr>
<td>Subclavian tortuosity</td>
<td>18%</td>
</tr>
<tr>
<td>Inadequate guide backup support</td>
<td>17%</td>
</tr>
</tbody>
</table>

n=2,100

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds Ratio</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 75</td>
<td>3.86</td>
<td>3.86 (2.33, 6.40)</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>7.48</td>
<td>7.48 (3.45, 16.19)</td>
</tr>
<tr>
<td>Height, cm</td>
<td>0.97</td>
<td>0.97 (0.95, 0.99)</td>
</tr>
</tbody>
</table>

![Graph showing TRA: Predictors of Failure](image-url)
Radial Loop
Traversing a radial loop
High Bifurcating Radial Artery
Brachial Tortuosity
Brachial Tortuosity
Brachial Tortuosity
Balloon Assisted Tracking

GUIDING CATHETER

PTCA WIRE

PTCA BALLOON

GUIDING CATHETER

PTCA WIRE

Patel T, et al CCI 2012
Razor Effect
Balloon Assisted Tracking

Patel T, et al CCI 2012
Effect of Inspiration

Panel A: During expiration there is a more acute angle ($\alpha$) between the brachiocephalic trunk and the ascending aorta, therefore the wire takes a more horizontal a more horizontal direction towards the descending aorta. Panel B: During deep inspiration, the diaphragm lowers the heart and straightens the angle ($\alpha$) between the brachiocephalic trunk and the ascending aorta. The wire takes a more vertical direction towards the ascending aorta.
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Most frequently used diagnostic coronary catheter shapes

- Tiger
- Jacky
- Amplatz Left
- LCB
- RCB
- Judkins Left
- Judins Right
- Multipurpose A2
- IM
- 3D LIMA
- IM VB-1
Transradial Curves for Left Coronary – Judkins Left

Standard curve for the left coronary artery (may be particularly useful for short left coronary arteries)

Sizing suggestions:
Downsize the curve by 0.5 from what is used for a femoral approach

Judkins engagement technique, similar to femoral approach. Very fine torquing movements may be required to direct the catheter toward the left coronary artery.
Transradial Curves for Left Coronary – Extra Backup

Workhorse curve for left coronary artery

Sizing suggestions:

JL3.5 = EBU3.5
JL4.0 = EBU3.75

Comparable to:
Cordis: XB, XBLAD
BSC: Muta Left, Radial Curve, Brachial Curve

Apply torque to point the tip to the left coronary cusp and turn catheter. Pull wire back and the catheter will engage the left coronary artery. Backup support from the sinus of Valsalva.
Jacky Catheter: Selective Engagement of RCA and LM
IKARI Left Catheter

Curve A to fit angle of brachiocephalic artery

Straight portion (20 mm) B to generate strong back-up force supported by opposite side of aorta wall.
Transradial Curves for Right Coronary – Judkins Right

Standard curve for right coronary artery (may be particularly useful for inferior takeoffs)

Sizing suggestions:
Same as femoral approach

Comparable to:
Cordis: Judkins Right
BSC: Judkins Right

Judkins engagement technique, similar to femoral approach. Apply a clockwise rotation to engage right coronary artery
Transradial Curves for Right Coronary – Judkins Right

Deep intubation of RCA with JR4
AMPLATZ for Complex PCI
AMPLATZ for Complex PCI
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Anticoagulation and Radial Artery Patency

- **No Heparin**: n=49, 71% Radial Occlusion
- **UFH 2000-3000 U**: n=119, 24% Radial Occlusion, P < 0.05
- **UFH 5000**: n=210, 4.3% Radial Occlusion, P < 0.05

*Assessed by Doppler examination

Catheter Size and Radial Artery Occlusion

Randomized Study
- N=171
- Procedural Success:
  - 95.4% of 5 Fr
  - 92.9% of 6 Fr

Radial Artery Occlusion
- 1.1% of 5 Fr
- 5.9% of 6 Fr

Dahm J et al. CCI 2002; 57:172–176
Reverse Allen’s test to determine post-procedural radial patency
Prevention of Radial Occlusion

**Patent Hemostasis**

- **Conventional Hemostasis**
  - Band left in place for 2 hours

- **Patent Hemostasis**
  - Loosen the pressure on the radial artery while compressing the ulnar artery until return of plethysmographic signal

![Bar chart showing comparison between early and persistent occlusion](chart)

- Early Occlusion (24h): 12 patients (P<0.05)
- Persistent Occlusion (30d): 7 patients (P<0.05)

n=436

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Fellows 21st Annual Interventional Cardiology Fellows Course
Compression time and RAO

- Early RAO:
  - 6 hours: 12%
  - 2 hours: 5.5%
  - $p = 0.025$

- Chronic RAO:
  - 6 hours: 8.5%
  - 2 hours: 3.5%
  - $p = 0.03$

$n=400$
Hematoma or Swelling in Holding? your best friends
Managing a Perforation

- Early recognition
- Wrap potential bleeding site
  - If seen on angiogram
  - If wire pushed too hard
- Okay to wrap and finish case
- Forearm swelling not related to hemostasis device at any time, consider wrap with elastic bandage
LEARNING STEPS AND COMPETENCY LEVELS

Level 1:
- Diagnostic procedures in male first and then in female patients with good radial pulse <70 years old

Level 2:
- Planned PCI in selected patients with type A or B lesions, stable clinical setting
- Diagnostic for all stable patients (elderly, bypass graft, short stature)

Level 3:
- PCI for all-comers in stable clinical setting including complex PCI
- STEMI patients
- NSTE-ACS patients
Core Curriculum

Transradial Arterial Access for Coronary and Peripheral Procedures: Executive Summary by the Transradial Committee of the SCAI

- Level 1 competency
  - Simple diagnostic cases on patients with favorable upper limb anatomy (large men).
- Level 2 competency
  - Simple diagnostic and interventional procedures on patients with more challenging upper limb anatomy (elective single vessel PCI; bypass grafts, small women, radial and subclavian loops).
- Level 3 competency
  - Complex interventional procedures even with challenging limb anatomy (CTOs, multivessel, AMI).
Implement a Radial Program

- SAFETY – SAFETY – SAFETY!!
- Learning curve of 50-100 cases
- Radial angiography requires awareness of anatomical variations and specific catheter manipulation
- Retrograde limited radial angiography helps in planning a strategy to save time and avoid vascular complications
- Consider left radial access as a first step for inexperienced operators during their learning curve
- Commit to radials – Create a policy and involve the staff
- Develop a same-day discharge PCI program
- Hospital administration delighted with cost-savings
References

Transradial Access and Intervention: A Step-by-Step Approach

Mauricio G. Cohen, MD Associate Professor of Medicine Director, Cardiac Cath Lab

21 fellow course 2015
THANK YOU