Overview of Trasradial Approach for Coronary Angiography and Intervention

A/Prof. Phạm Mạnh Hùng, MD.FACC., FESC
Outline

- Historical perspective and current trends
- Rationale for the radial approach
  - Bleeding complications
- Comparison of radial and femoral access
- Radial approach in special cases
- Some radial specific issues
- Learning curve
Historical Perspective

- **1948**: First attempted transradial coronary angiogram using **radial cut-down**
  - 8-10 F catheters: too big for the radial artery!
- **1989**: Campeau reported first 100 cases of **percutaneous** transradial coronary angiogram
- **1993**: First transradial coronary angioplasty with stent implantation performed (Kimenei, Saito)
  - Performed using 6F guide catheter
- **VNHI**: 2000
Current Trends

Figure 2. Trend in the Use of r-PCI Over Time in Key Subgroups

Trend in the use of the radial approach to percutaneous coronary intervention (r-PCI) over time in (A) the overall dataset; (B) patients age <75 and ≥75 years; (C) men and women; (D) patients with stable angina, non–ST-segment elevation acute coronary syndrome (NSTE ACS), and ST-segment elevation myocardial infarction (STEMI).

TRA preference in VHI

- TRI: 0% in 2000 become 98% in 2007: TRI is first choice !!!
- Feasible, suitable for resource insufficient but overload situation like Vietnam: 20++ cases per day per lab
- TRI is safe & effectiveness even for AMI (> 90% in VNHI)
- TRI still work for abnormal origin of RCA/LCA and IMA
- “Learning curve” required
- PCI through TRI should be very cautious if patient weight is less than 45 kg !!!
- Specialized devices are fundamental
- ...
Switch to TRI since 2005 at VHI

%
Rationale for use of TRA

Advantages:
- Reduced risk of major bleeding
- Improved patient comfort and convenience
- Immediate ambulation
- Reduced inpatient time and cost, faster turnover of beds
Bleeding Complications

- Advances in antiplatelet and anticoagulant therapies in patients with ACS undergoing PCI have reduced ischemic events and improved overall outcomes.
- Bleeding complications remain a relatively infrequent but significant problem.
- Bleeding associated with increase risk of mortality, recurrent MI and stroke.
Meta-analysis of Bleeding in ACS

Data from 10 studies up to March 2007 included in a meta-analysis of studies in ACS where incidence of major bleeding and outcomes was published.

Hamon et al, EuroIntervention 2007; 3: 400-408

**Figure 2.** Pooled relative risks of mortality increase in patients with ACS and major bleeding: random-effects meta-analysis of 10 studies.
Major Femoral Bleeding Post-PCI

- Mayo clinic PCI database 1994-2005
- Changes in type, intensity and duration of anticoagulation protocols over time

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>2441</td>
<td>6207</td>
<td>9253</td>
</tr>
<tr>
<td><strong>Sheath size (F)</strong></td>
<td>8.2 ± 0.7</td>
<td>7.8 ± 0.9</td>
<td>6.4 ± 0.8</td>
</tr>
<tr>
<td><strong>GP Iib/IIIa use</strong></td>
<td>27 (1%)</td>
<td>2536 (41%)</td>
<td>5328 (58%)</td>
</tr>
<tr>
<td><strong>Peak ACT</strong></td>
<td>405 ± 110</td>
<td>339 ± 79</td>
<td>312 ± 61</td>
</tr>
<tr>
<td><strong>Heparin post procedure</strong></td>
<td>1995 (80%)</td>
<td>2215 (36%)</td>
<td>2456 (27%)</td>
</tr>
</tbody>
</table>

Doyle et al, JACC Interventions 2008 ; 1: 202-9
Major Femoral Bleeding Post-PCI

Figure 1. Changing Incidence of Major Femoral Bleeding Complications From 1994 to 2005

The incidence of major femoral bleeding declined significantly from the earliest (8.4%) to the contemporary time period (3.5%).

Doyle et al, JACC Interventions 2008; 1: 202-9
**OASIS-5: Fondaparinux**

- Comparison of Fondaparinux vs Enoxaparin in patients with ACS

<table>
<thead>
<tr>
<th>Time and Outcome</th>
<th>Enoxaparin (N=10,021)</th>
<th>Fondaparinux (N=10,057)</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value for Superiority</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death, MI, or refractory ischemia</td>
<td>573 (5.7)</td>
<td>579 (5.8)</td>
<td>1.01 (0.90–1.13)</td>
<td>NA</td>
</tr>
<tr>
<td>Death or MI†</td>
<td>412 (4.1)</td>
<td>409 (4.1)</td>
<td>0.99 (0.86–1.13)</td>
<td>NA</td>
</tr>
<tr>
<td>Death</td>
<td>186 (1.9)</td>
<td>177 (1.8)</td>
<td>0.95 (0.77–1.17)</td>
<td>NA</td>
</tr>
<tr>
<td>MI</td>
<td>264 (2.7)</td>
<td>263 (2.6)</td>
<td>0.99 (0.84–1.18)</td>
<td>NA</td>
</tr>
<tr>
<td>Refractory ischemia</td>
<td>188 (1.9)</td>
<td>194 (1.9)</td>
<td>1.03 (0.84–1.26)</td>
<td>NA</td>
</tr>
<tr>
<td>Stroke</td>
<td>45 (0.5)</td>
<td>37 (0.4)</td>
<td>0.82 (0.53–1.27)</td>
<td>NA</td>
</tr>
<tr>
<td>Major bleeding</td>
<td>412 (4.1)</td>
<td>217 (2.2)</td>
<td>0.52 (0.44–0.61)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Death, MI, refractory ischemia, or major bleeding</td>
<td>905 (9.0)</td>
<td>737 (7.3)</td>
<td>0.81 (0.73–0.89)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Death, MI, or stroke</td>
<td>446 (4.5)</td>
<td>435 (4.3)</td>
<td>0.97 (0.85–1.11)</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Yusuf et al, NEJM 2006; 354: 1464-1476
Choice of Access Site in ACUITY

- No difference in composite outcome of death / MI / ischemia at 30 days or at 1 year
- Bleeding:

<table>
<thead>
<tr>
<th></th>
<th>Radial</th>
<th>Femoral</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access site bleeding</td>
<td>0.9%</td>
<td>2.1%</td>
<td>0.009</td>
</tr>
<tr>
<td>TIMI non-CABG major bleeding</td>
<td>1.0%</td>
<td>1.5%</td>
<td>0.37</td>
</tr>
<tr>
<td>Non-CABG major bleeding</td>
<td>3.0%</td>
<td>4.8%</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Hamon, EuroIntervention 2009; 1: 115-20
MORTAL Study - Transfusion

- Odds Ratios (adjusted for baseline characteristics) for mortality related to receiving transfusion vs no transfusion:
  - 30 day: 4.01 (95% CI 3.08 to 5.22)
  - 1 year: 3.58 (95% CI 2.94 to 4.36)

- Propensity Score Matching confirmed higher risk of 30d and 1 year mortality if transfused

Chase et al, Heart 2008; 94: 1019-1025
MORTAL Study – Access Site

- Odds Ratios (adjusted for baseline characteristics) for receiving a transfusion based on Radial vs Femoral access:
  - 0.59 (95% CI 0.48 to 0.73), p < 0.001

- Adjusted OR for mortality: TRA vs TFA
  - 30 day: 0.71 (95% CI 0.61 to 0.82) p < 0.001
  - 1 year: 0.83 (95% CI 0.71 to 0.98) P < 0.001

- If only non-transfused procedures analyzed, difference in mortality non-significant
  - Supports hypothesis that mortality difference closely linked with need for transfusion

Chase et al, Heart 2008; 94: 1019-1025
RIVIERA Study

- Multinational prospective observation study to determine predictors of adverse outcomes following PCI
- 7962 patients from 23 countries
- Both elective (92%) and primary PCI (8%)
- Radial approach: 841 pts (10.6%)
- Femoral approach: 7062 pts (89.2%)

RIVIERA Study: Death / MI

Fig. 1. Independent predictors of death or myocardial infarction. *Reference is asymptomatic or unstable angina. CI, confidence interval; GP; glycoprotein; LADCA, left anterior descending coronary artery; NSTE-ACS, non-ST-segment elevation acute coronary syndrome; OR, odds ratio; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction; UFH, unfractionated heparin.

RIVIERA Study: Bleeding

Fig. 2. Independent predictors of bleeding. ACE, angiotensin-converting enzyme; ARA, adenosine receptor antagonist; CI, confidence interval; GP, glycoprotein; IMAG+SG, internal mammary artery graft or saphenous graft; OR, odds ratio; UFH, unfractionated heparin.
Why all this talk about bleeding?

- Bleeding complications are a big deal
- Needing a transfusion after cath is a marker of high risk – strongly (perhaps even causally) related to adverse events
- Efforts to further reduce risk of bleeding and reduce the chance of needing a transfusion are of utmost importance
Why transradial?
Transradial vs. Transfemoral

Figure 1: Possible Mechanisms Linking Post-Percutaneous Coronary Intervention Bleeding With Increased Mortality

Figure provided by the Mayo Clinic ©2008.
Meta-analysis 2: – Radial vs Femoral

- 23 studies included spanning 1993 – 2007
- Major Bleeding:
  - Radial: 0.5% (13 / 2390 pts)
  - Femoral: 2.3% (48 / 2068 pts)
    OR: 0.27 (95% CI 0.16 – 0.45, p < 0.001)
- Trend towards reduced composite of death / MI / stroke
  - OR: 0.71 (95% CI 0.49 – 1.01, p = 0.058)
- Trend towards reduced mortality
  - OR 0.74 (95% CI 0.42 – 1.30, p = 0.29)

### Meta-analysis - Radial vs. Femoral: Procedure Failure Rate

<table>
<thead>
<tr>
<th>Study name</th>
<th>PCI Failure / Total</th>
<th>Peto odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial</td>
<td>Femoral</td>
</tr>
<tr>
<td>ACCESS</td>
<td>13 / 300</td>
<td>10 / 300</td>
</tr>
<tr>
<td>Bodi</td>
<td>21 / 252</td>
<td>12 / 153</td>
</tr>
<tr>
<td>BRAFE</td>
<td>6 / 50</td>
<td>1 / 55</td>
</tr>
<tr>
<td>FARMI</td>
<td>1 / 57</td>
<td>1 / 57</td>
</tr>
<tr>
<td>Mann 1996</td>
<td>4 / 73</td>
<td>2 / 75</td>
</tr>
<tr>
<td>Mann 1998</td>
<td>0 / 68</td>
<td>3 / 77</td>
</tr>
<tr>
<td>OUTCLAS</td>
<td>13 / 322</td>
<td>10 / 322</td>
</tr>
<tr>
<td>RADIAL AMI</td>
<td>1 / 25</td>
<td>0 / 25</td>
</tr>
<tr>
<td>RADIAMI</td>
<td>0 / 50</td>
<td>1 / 50</td>
</tr>
<tr>
<td>TEMPURA</td>
<td>1 / 77</td>
<td>0 / 72</td>
</tr>
<tr>
<td></td>
<td>60 / 1274</td>
<td>40 / 1186</td>
</tr>
</tbody>
</table>

**OR 1.31 (95% CI 0.87, 1.96) p=0.20**

- Non-significant trend towards more PCI failure with radial.

Unadjusted Rates of the Primary Outcomes of r-PCI and f-PCI

Unadjusted Rates of Bleeding and Vascular Complications of r-PCI and f-PCI in Key Subgroups: AGE

Unadjusted Rates of Bleeding and Vascular Complications of r-PCI and f-PCI in Key Subgroups: GENDER

Unadjusted Rates of Bleeding and Vascular Complications of r-PCI and f-PCI in Key Subgroups: Indication for PCI

TRI in special cases

- AMI
- CTO?
- Bifurcation?
- And…
TRI in AMI
SCAAR trial (PCR 2012)

Adjusted Cumulative Risk of death for up to 1 year: transfemoral vs. transradial access site

Adjusted OR (95% CI)
0.78 (0.64-0.96)
P = 0.018
RIVAL Study Design

Key Inclusion:
• Intact dual circulation of hand required
• Interventionalist experienced with both (minimum 50 radial procedures in last year)

Randomization

Radial Access (n=3507)  Femoral Access (n=3514)

Blinded Adjudication of Outcomes

Primary Outcome: Death, MI, stroke or non-CABG-related Major Bleeding at 30 days

# Primary and Secondary Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Radial (n=3507) %</th>
<th>Femoral (n=3514) %</th>
<th>HR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Outcome</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death, MI, Stroke, Non-CABG Major Bleed</td>
<td>3.7</td>
<td>4.0</td>
<td>0.92</td>
<td>0.72-1.17</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Secondary Outcomes</strong></td>
<td></td>
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</tr>
<tr>
<td>Death, MI, Stroke</td>
<td>3.2</td>
<td>3.2</td>
<td>0.98</td>
<td>0.77-1.28</td>
<td>0.90</td>
</tr>
<tr>
<td>Non-CABG Major Bleeding</td>
<td>0.7</td>
<td>0.9</td>
<td>0.73</td>
<td>0.43-1.23</td>
<td>0.23</td>
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</tbody>
</table>
## Other Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Radial (n=3507)</th>
<th>Femoral (n=3514)</th>
<th>HR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Vascular Access Site Complications</td>
<td>1.4</td>
<td>3.7</td>
<td>0.37</td>
<td>0.27-0.52</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Other Definitions of Major Bleeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TIMI Non-CABG Major Bleeding</td>
<td>0.5</td>
<td>0.5</td>
<td>1.00</td>
<td>0.53-1.89</td>
<td>1.00</td>
</tr>
<tr>
<td>ACUITY Non-CABG Major Bleeding*</td>
<td>1.9</td>
<td>4.5</td>
<td>0.43</td>
<td>0.32-0.57</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

* Post Hoc analysis
### Other Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Radial (n=3507)</th>
<th>Femoral (n=3514)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access site Cross-over (%)</td>
<td>7.6</td>
<td>2.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>PCI Procedure duration (min)</td>
<td>35</td>
<td>34</td>
<td>0.62</td>
</tr>
<tr>
<td>Fluoroscopy time (min)</td>
<td>9.3</td>
<td>8.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Persistent pain at access site &gt;2 weeks (%)</td>
<td>2.6</td>
<td>3.1</td>
<td>0.22</td>
</tr>
<tr>
<td>Patient prefers assigned access site for next procedure (%)</td>
<td>90</td>
<td>49</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

- Symptomatic radial occlusion requiring medical attention 0.2% in radial group
TRI in CTO?

Feasibility of Transradial Coronary Intervention for the Treatment of Chronic Total Occlusions

Yutaka Tanaka, Satoshi Takeshita, Junya Matsumi, Shingo Mizuno, Kazuya Sugitatsu, Futoshi Yamanaka, Yumiko Osaka, Yu Nomura, Koki Shishido, Hidetaka Suenaga, Masato Murakami, Saeko Takahashi, Shigeru Saito

TCT 2011
TRI in CTO?

Success rate

P Value = ns

83.9

75.9

TRI group

TFI group

TCT 2011
TRI for LM

Transradial Versus Transfemoral Method of Percutaneous Coronary Revascularization for Unprotected Left Main Coronary Artery Disease: Comparison of Procedural and Late-Term Outcomes

Yue-Jin Yang, MD,* David E. Kandzari, MD,† Zhan Gao, MD,* Bo Xu, MBBS,* Ji-Lin Chen, MD,* Shu-Bin Qiao, MD,* Jian-Jun Li, MD,* Xue-Wen Qin, MD,* Min Yao, MD,* Yong-Jian Wu, MD,* Jin-Qing Yuan, MD,* Jue Chen, MD,* Hai-Bo Liu, MD,* Jun Dai, MD,* Tao Chen, MSc,* Yang Wang, PhD,* Wei Li, PhD,* Run-Lin Gao, MD*

Beijing, China; and Atlanta, Georgia
### Table 3. In-Hospital and Late Clinical Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Transradial (n = 353)</th>
<th>Transfemoral (n = 468)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-hospital outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular death</td>
<td>2 (0.6)</td>
<td>3 (0.6)</td>
<td>1.00</td>
</tr>
<tr>
<td>Nonfatal MI</td>
<td>10 (2.8)</td>
<td>7 (1.5)</td>
<td>0.22</td>
</tr>
<tr>
<td>Overall TVR (%)</td>
<td>4 (1.1)</td>
<td>9 (1.9)</td>
<td>0.41</td>
</tr>
<tr>
<td>Left main specific TVR (%)</td>
<td>2 (0.6)</td>
<td>5 (1.1)</td>
<td>0.70</td>
</tr>
<tr>
<td>MACE</td>
<td>14 (4.0)</td>
<td>15 (3.2)</td>
<td>0.57</td>
</tr>
<tr>
<td>Hospital stay duration, days</td>
<td>8.5 ± 5.9</td>
<td>9.9 ± 5.9</td>
<td>0.0001</td>
</tr>
<tr>
<td>Hospital duration post-revascularization</td>
<td>4.5 ± 4.0</td>
<td>5.1 ± 3.4</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Late clinical outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MACE (%)</td>
<td>36 (10.2)</td>
<td>43 (9.2)</td>
<td>0.63</td>
</tr>
<tr>
<td>Cardiac death (%)</td>
<td>5 (1.4)</td>
<td>8 (1.7)</td>
<td>0.74</td>
</tr>
<tr>
<td>Nonfatal MI (%)</td>
<td>14 (4.0)</td>
<td>12 (2.6)</td>
<td>0.26</td>
</tr>
<tr>
<td>Fatal MI</td>
<td>1 (0.3)</td>
<td>5 (1.1)</td>
<td>0.24</td>
</tr>
<tr>
<td>Overall TVR (%)</td>
<td>28 (7.9)</td>
<td>35 (7.5)</td>
<td>0.89</td>
</tr>
<tr>
<td>LM-specific TVR (%)</td>
<td>20 (5.7)</td>
<td>27 (5.8)</td>
<td>0.95</td>
</tr>
<tr>
<td>Stent thrombosis (%)</td>
<td>4 (1.1)</td>
<td>12 (2.6)</td>
<td>0.13</td>
</tr>
<tr>
<td>Early (%)</td>
<td>1 (0.3)</td>
<td>3 (0.6)</td>
<td>0.64</td>
</tr>
<tr>
<td>Late (%)</td>
<td>2 (0.6)</td>
<td>5 (1.1)</td>
<td>0.71</td>
</tr>
<tr>
<td>Very late (%)</td>
<td>1 (0.3)</td>
<td>4 (0.9)</td>
<td>0.40</td>
</tr>
</tbody>
</table>
Radiation Exposure

- Study performed in Germany where one experienced operator (>1500 radial cases) performed coronary angiography ± PCI
- Pts randomized to TR or TF approach
- Radiation dosimeter used to measure operator exposure in μSv
- Patient radiation dose measured in terms of dose-area product (Gy.cm²) and fluoroscopy time

Lange et al, CCI 2006; 67: 12-16
Radiation Exposure

Close attention to techniques and precautions for minimizing exposure needed.

- Coronary angiography (n)
  - Fluoroscopy time (min): Femoral 1.7 ± 1.4, Radial 2.8 ± 2.1, < 0.001
  - Dose-area product (Gy · cm^2): Femoral 13.1 ± 8.5, Radial 15.1 ± 8.4, < 0.05
  - Radiation exposure (μSv)^a: Femoral 32 ± 39, Radial 64 ± 55, < 0.001

- Percutaneous intervention (n)
  - Fluoroscopy time (min): Femoral 10.4 ± 6.8, Radial 11.4 ± 8.4, NS
  - Dose-area product (Gy · cm^2): Femoral 51.0 ± 29.4, Radial 46.3 ± 28.7, NS
  - Radiation exposure (μSv)^a: Femoral 110 ± 115, Radial 166 ± 188, < 0.05

Lange et al, CCI 2006; 67: 12-16
Radial Artery Occlusion

- **Incidence post TRA:**
  - 5% based on clinical diagnosis
  - 9% based on ultrasonography

- **Risk of RAO independently associated with**
  - sheath/artery ratio > 1
  - Lack of peri-procedural anticoagulation

- **Hand ischemia rare, but RAO has implications for:**
  - access for subsequent coronary angiography
  - future use of radial artery as graft for CABG or fistula for HD
**Patent Hemostasis Reduces RAO**

- **PROPHET**: 436 patients randomized to:
  - **Conventional Hemostasis**
    - Hemoband applied with immediate sheath removal
    - Band removed after 2 hrs
    - Radial patency was checked using Barbeau’s test but pressure not adjusted (43% were occlusive)
  - **Patent Hemostasis**
    - Pulse oximeter sensor applied to index finger
    - Ulnar artery occluded with manual pressure
    - Hemoband applied as above, loosened until signal returned → confirms radial patent
    - Band removed after 2 hrs as above

  Pancholy et al, CCI 2008; 2: 335-340
Patent Hemostasis Reduces RAO

Fig. 1. Patent hemostasis leads to a significant decrease in the incidence of radial artery occlusion at 24-hr and 30-day follow-up.
Radial Artery as Graft After TRA?

Fig 1. Early stenosis-free graft patency rates of the groups. (ITA = internal thoracic artery; RA = radial artery; SV = saphenous vein.)

Learning Curve

- Trans-radial approach perceived as more difficult to learn than trans-femoral
  - Small sized vessel
  - Prone to spasm
  - Higher percentage of anatomic variation
  - Can be difficult to transverse the subclavian and aortic arch
Learning Curve

- Early studies report failure rates of:
  - First 50 cases: around 10%
  - First 500 cases: 3-4%
  - After 1000 cases: approx 1%

Spaulding et al, Cath Cardiovasc Diagnosis 1996; 39: 365-370

Fig. 5. Learning curve procedure failure rate, sheath insertion delay, and procedure duration.
Results

- The proficiency of each operator in the first 50 cases is seen on this graph.

- Proficiency in each of the learning curve components was defined as achieving values within the 90th percentile of the control operator in >80% of cases.

![Bar chart showing proficiency for different operators](chart.png)

- Access time goal < 6 min
- Fluoro time goal < 10 min
- Proc. time goal < 36 min
- Contrast goal < 100 ml
Summary

- Trans-radial PCI is a safe and effective alternative to the trans-femoral approach, both for elective and emergent cases
- Associated with reduction in bleeding complications and need for transfusion
- TRI is feasible in selected complicated PCI: CTO; LM…
- High success rates after initial learning curve period