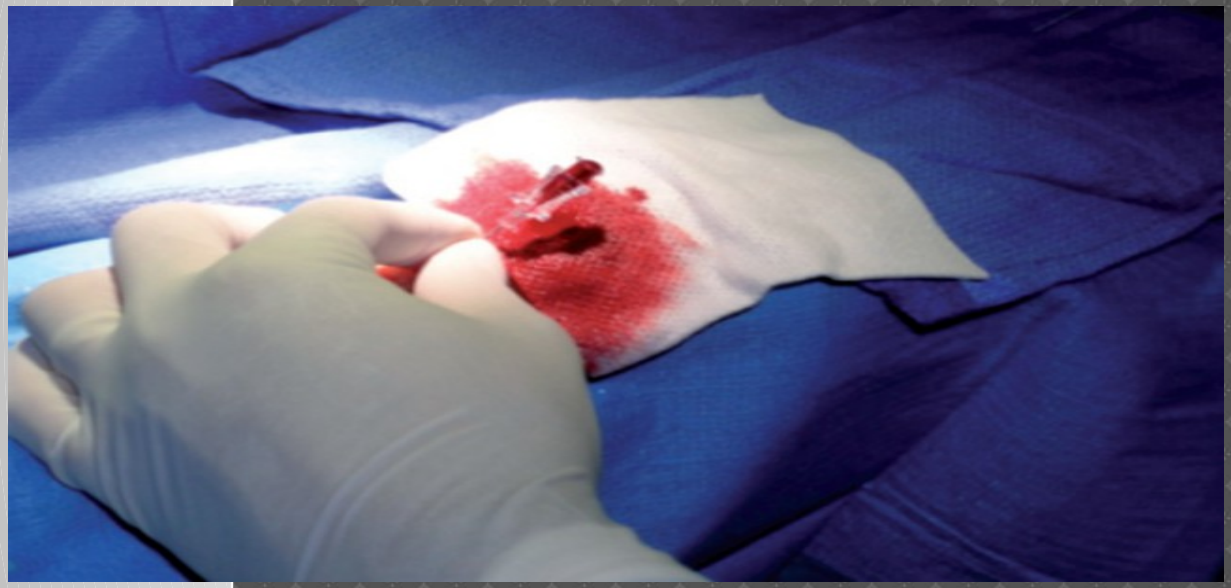
TRANSRADIAL CARDIAC CATHETERIZATION



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April 13, 2013

TOPICS

- Historical perspective and current trends
- Rationale for the radial approach
  - Bleeding complications
- Comparison of radial and femoral access
- Transradial STEMI program
- Some radial specific issues
- Educational resources and training

OBJECTIVES

- Understand transradial approach to cardiac catheterization
- Discuss risks and benefits of transradial approach
- Key goals for developing an aggressive transradial approach
- Identify education and resources for catheterization

Historical Perspective

- 1948: First attempted transradial coronary angiogram using **radial cut-down**
  - 8-10 F catheters: too large for most radials
- 1989: Campeau reported first 100 cases of **percutaneous** transradial coronary angiograms
- 1993: First transradial coronary angioplasty with stent implantation performed
  - Performed using 6F guide catheter

Current Trends

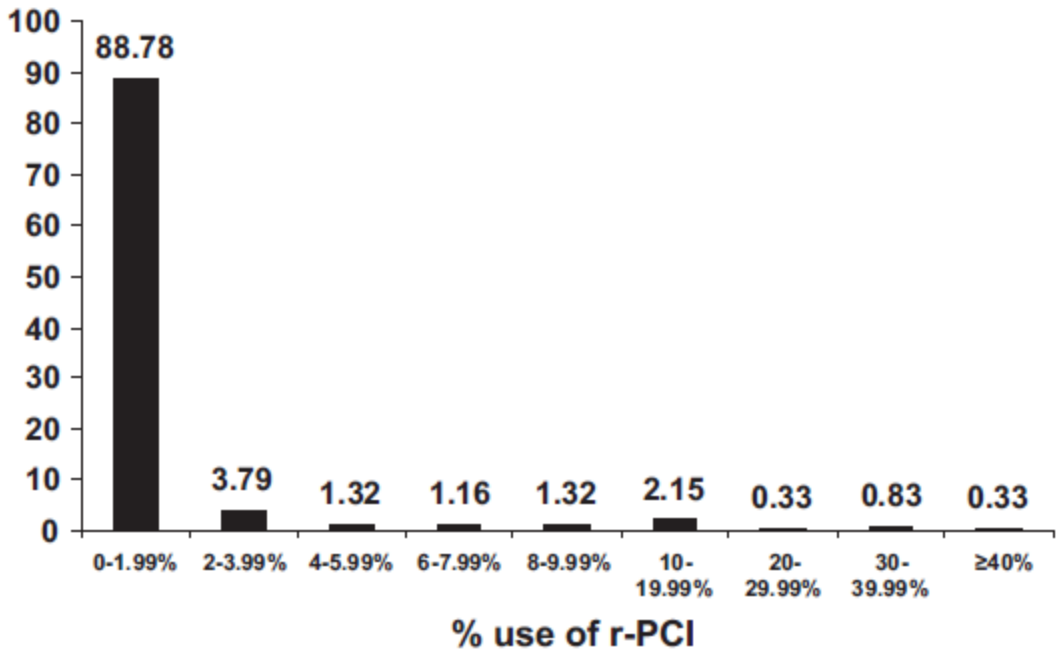


Figure 1. Proportion of PCI Cases Performed Via the Radial Artery

Proportion of percutaneous coronary intervention (PCI) cases performed via the radial artery approach (r-PCI) across sites.

Rao et al, JACC Interventions 2008; 1: 379-386

Current Trends

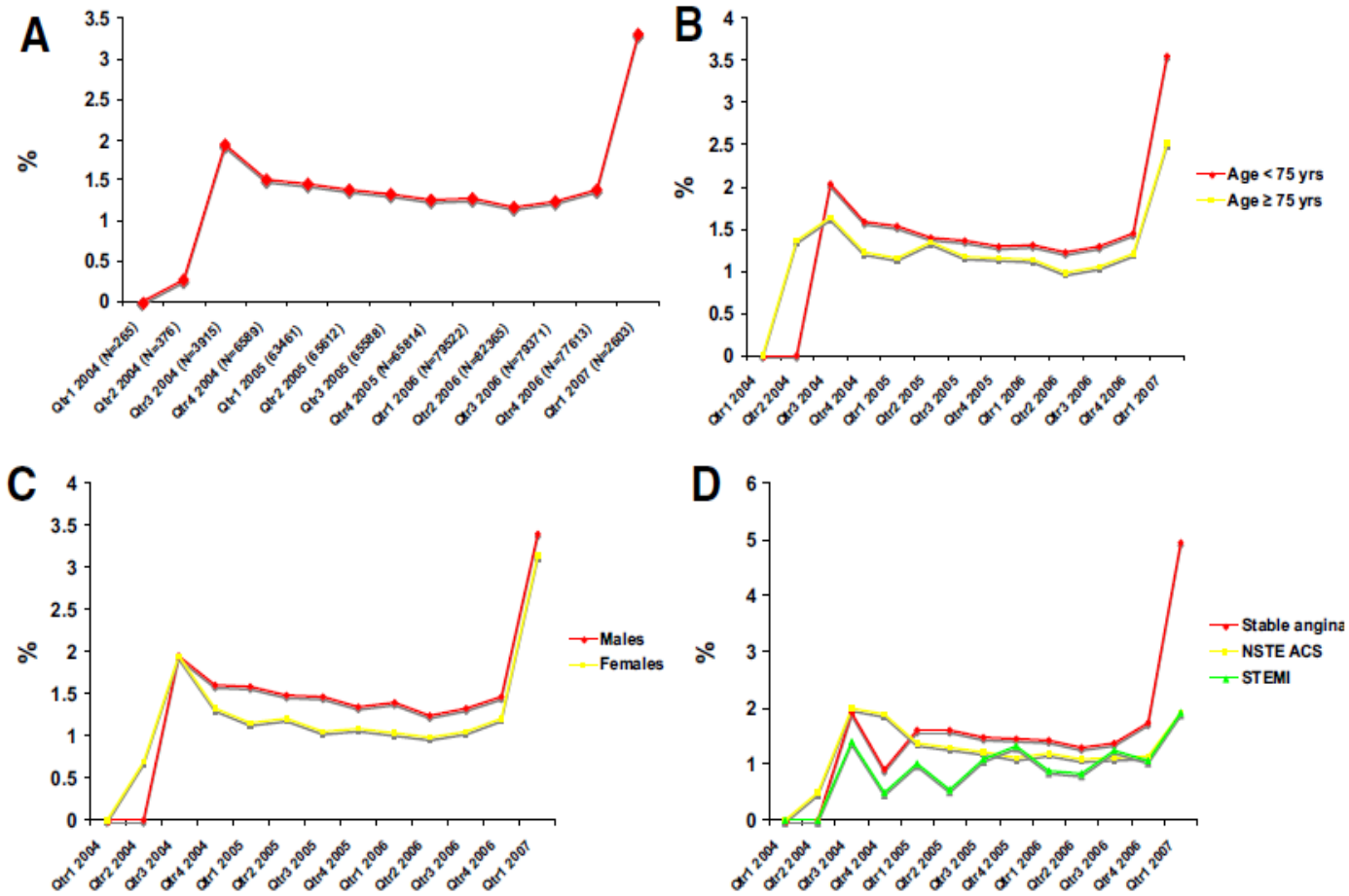


Figure 2. Trend in the Use of r-PCI Over Time in Key Subgroups

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).

Rao et al, JACC Interventions 2008; 1: 379-386

Rationale for use of TRA

嫋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 have remained relatively constant in cardiac cath/PCI
- Bleeding associated with increase risk of mortality, recurrent MI and stroke

Meta-analysis of Bleeding in ACS

Study	Major bleeding	No major bleeding	RR (95% CI)
	Deaths, No. / Patients, No.		
Ali et al 2004	9/89	24/931	3.92 [1.88, 8.18]
Eikelboom et al 2006	60/470	833/33676	5.16 [4.04, 6.60]
Feit et al 2007	10/194	9/5807	33.26 [13.67, 80.92]
Kinnaird et al 2003	44/588	54/8992	12.46 [8.44, 18.39]
Lenderink et al 2004	18/98	120/7702	11.79 [7.49, 18.55]
Manoukian et al 2007	47/644	159/13175	6.05 [4.41, 8.29]
Moscucci et al 2003	85/546	624/15348	3.83 [3.10, 4.72]
Rao et al 2005	79/307	549/19110	8.96 [7.28, 11.02]
Segev et al 2005	15/79	86/5763	12.72 [7.71, 21.01]
Yusuf et al 2006	83/629	545/19449	4.71 [3.79, 5.85]
Total (95% CI)	450/3644	3003/129953	7.60 [5.55, 10.40]

Test for heterogeneity: Chi ≤85.44, df=9 (P<0.00001), I≤89.5%

Test for overall effect: Z=12.65 (P<0.00001)

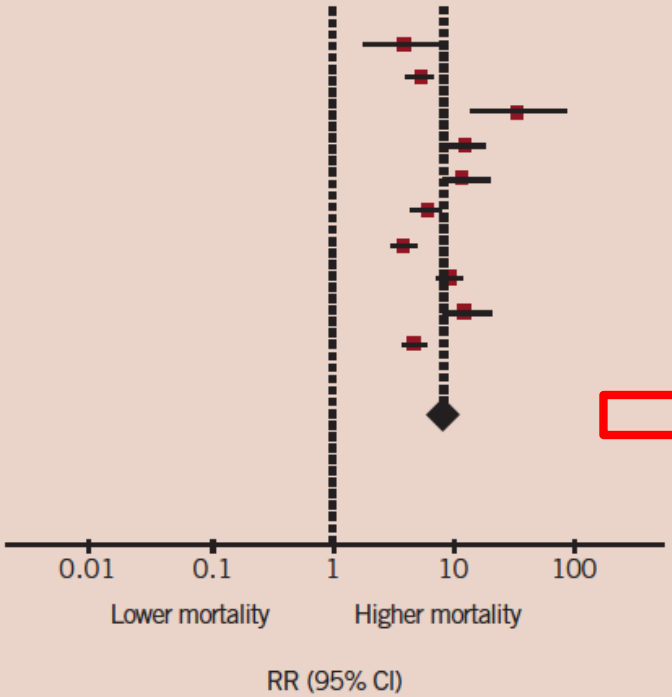


Figure 2. Pooled relative risks of mortality increase in patients with ACS and major bleeding: random-effects meta-analysis of 10 studies.

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

Major Femoral Bleeding Post-PCI

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

	Group 1 1994-1995	Group 2 1996-1999	Group 3 2000-2005
n	2441	6207	9253
Sheath size (F)	8.2 ± 0.7	7.8 ± 0.9	6.4 ± 0.8
GP Iib/IIIa use	27 (1%)	2536 (41%)	5328 (58%)
Peak ACT	405 ± 110	339 ± 79	312 ± 61
Heparin post procedure	1995 (80%)	2215 (36%)	2456 (27%)

Doyle et al, JACC Interventions 2008 ; 1: 202-9

Major Femoral Bleeding Post-PCI

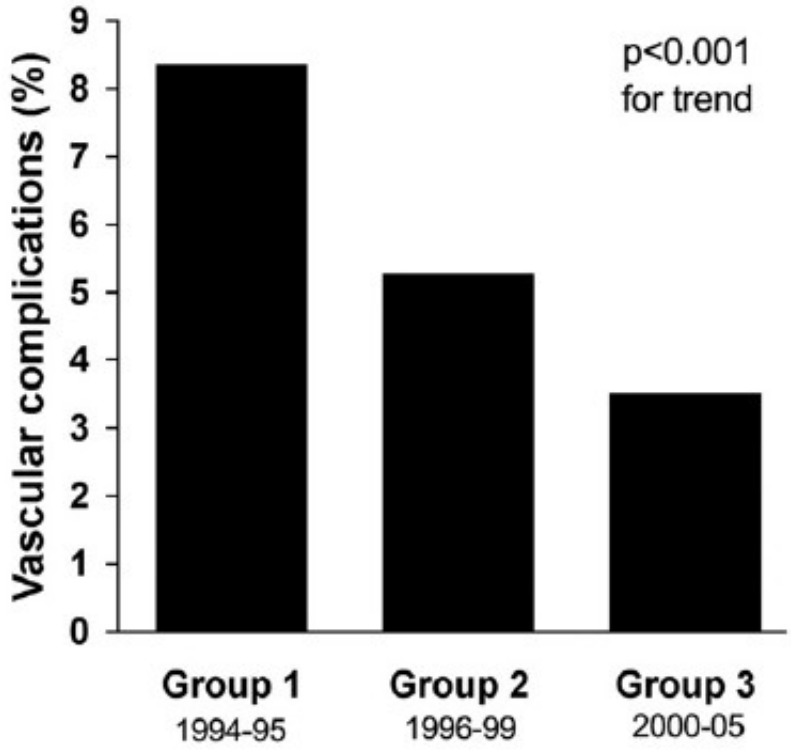


Figure 1. Changing Incidence of Major Femoral Bleeding Complications From 1994 to 2005

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

Time and Outcome	Enoxaparin (N=10,021)	Fondaparinux (N=10,057)	Hazard Ratio (95% CI)	P Value for Superiority
	no. of events (% of patients)			
9 Days				
Death, MI, or refractory ischemia	573 (5.7)	579 (5.8)	1.01 (0.90–1.13)	NA
Death or MI†	412 (4.1)	409 (4.1)	0.99 (0.86–1.13)	NA
Death	186 (1.9)	177 (1.8)	0.95 (0.77–1.17)	NA
MI	264 (2.7)	263 (2.6)	0.99 (0.84–1.18)	NA
Refractory ischemia	188 (1.9)	194 (1.9)	1.03 (0.84–1.26)	NA
Stroke	45 (0.5)	37 (0.4)	0.82 (0.53–1.27)	NA
Major bleeding	412 (4.1)	217 (2.2)	0.52 (0.44–0.61)	<0.001
Death, MI, refractory ischemia, or major bleeding	905 (9.0)	737 (7.3)	0.81 (0.73–0.89)	<0.001
Death, MI, or stroke	446 (4.5)	435 (4.3)	0.97 (0.85–1.11)	0.67

Yusuf et al, NEJM 2006; 354: 1464-1476

OASIS-5: Fondaparinux

- Regardless of Treatment Arm, those who suffered a major bleeding event had worse outcomes at 30 days:
  - Increased risk of death (13.2% vs 2.8%)
  - Increased risk of MI (11.9% vs 3.6%)
  - Increased risk of stroke (3.5% vs 0.7%)

Yusuf et al, NEJM 2006; 354: 1464-1476

Choice of Access Site in ACUITY

- Femoral site chosen in 93.8%
- Radial site chosen in 6.2%
- Subgroup analysis with some important differences in baseline characteristics:
  - Femoral approach more commonly used in:
    - Older patients
    - Females
    - Established CAD
    - Enrolled in the US

Hamon, EuroIntervention 2009; 1: 115-20

Choice of Access Site in ACUITY

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

	Radial	Femoral	P-value
Access site bleeding	0.9%	2.1%	0.009
TIMI non-CABG major bleeding	1.0%	1.5%	0.37
Non-CABG major bleeding	3.0%	4.8%	0.03

Hamon, EuroIntervention 2009; 1: 115-20

MORTAL Study

- British Columbia Cardiac Registry (similar to NCDR) used to evaluate patients who had undergone PCI from 1999-2005
- Cross-referenced with Central Transfusion Registry to identify patients transfused within 10 days of PCI
- Objective:
  - To determine association of arterial access site (radial vs femoral) with transfusion and mortality

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

MORTAL Study

- Baseline characteristics: multiple variables with statistically significant differences

Variable	Radial N = 7,972	Femoral N = 30,900	P-value
Elective	32.4%	26.3%	< 0.01
Urgent	55.3%	62.4%	< 0.01
Dialysis	0.7%	1.8%	< 0.01
Prior MI	25.5%	34.1%	< 0.01
Prior CABG	6.9%	13.5%	< 0.01
**Liver/GI comorbidities	2.4%	6.9%	< 0.01
**Malignancy	2.3%	7.2%	< 0.01

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 1year 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 v 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

Mortality & Bleeding / Transfusion

Table 1 Studies of the Impact of Major Bleeding on Mortality After PCI

Author/Study (Ref. #)	Patients (n)	Patient Population	STEMI Included?	Definition	Frequency of Blood Transfusion (%)	Impact of Bleeding on Mortality [95% Confidence Interval]	p Value
Kinnaird et al. (1)	10,974	Unselected	Yes	TIMI	5.4	30-day adjusted OR: 3.5 [1.9–6.7]	<0.0001
REPLACE-2 (2)	6,001	Elective and 'urgent' PCI	No	Protocol†	3.2	1-year adjusted OR: 2.66 [1.44–4.92]	0.002
Ndrepepa et al. (3)	5,348	Elective, ACS	No	TIMI	4.0	1-year adjusted HR: 2.96 [1.96–4.48]	<0.0001
ACUITY (4)	13,819	ACS only	No	Protocol†	4.7	30-day OR: 7.55 [4.68–12.18]	<0.0001
Kim et al. (5)	6,799	Unselected	Yes	Protocol†	8.0	1-year RR: 2.03 (transfused patients)	0.0028
Doyle et al. (6)	17,901	Unselected	Yes	Protocol†	4.8	30-day adjusted HR: 9.96 [6.94–14.3]	<0.0001
GRACE registry (7)*	24,045	ACS	Yes	Protocol†	3.9	In-hospital adjusted OR: 1.64 [1.18–2.28]	<0.0001
Yatskar et al. (8)	6,656	Unselected	Yes	Protocol†	1.8	In-hospital adjusted OR: 3.59 [1.66–7.77]	0.001
						1-year adjusted HR: 1.65 [1.01–2.70]	0.048

Table 2 Studies of the Impact of Blood Transfusion on Mortality After PCI

Author (Ref. #)	Patients (n)	Patient Population	STEMI Included?	Frequency of Blood Transfusion (%)	Impact of Transfusion on Mortality [95% Confidence Interval]	p Value
Jani et al. (12)	4,623	Anemic patients with MI	Yes	22.3	In-hospital, adjusted OR: 2.02 [1.47–2.79]	<0.0001
Doyle et al. (6)	17,901	Unselected	Yes	6.8	30 days, 1–2 U adjusted HR: 8.9 [6.3–12.6]	<0.0001
					3+ U adjusted HR: 18.1 [13.7–24]	<0.0001
Kinnaird et al. (1)	10,974	Unselected	Yes	5.4	1 year, OR per unit transfused: 1.47 [1.36–1.55]	<0.0001
Kim et al. (5)*	567*	Severe bleeding	Yes	25.7	1 year, RR: 2.03	0.0028
Chase et al. (13)	38,872	Unselected	Yes	3.5	30-day adjusted OR: 4.01 [3.08–5.22]	<0.0001
					1-year adjusted OR: 3.58 [2.94–4.36]	<0.0001

Doyle et al, JACC 2009; 53: 2019-27

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%)

Montelescot et al, Int J Card 2008; 129(3): 379-387

RIVIERA Study: Death / MI

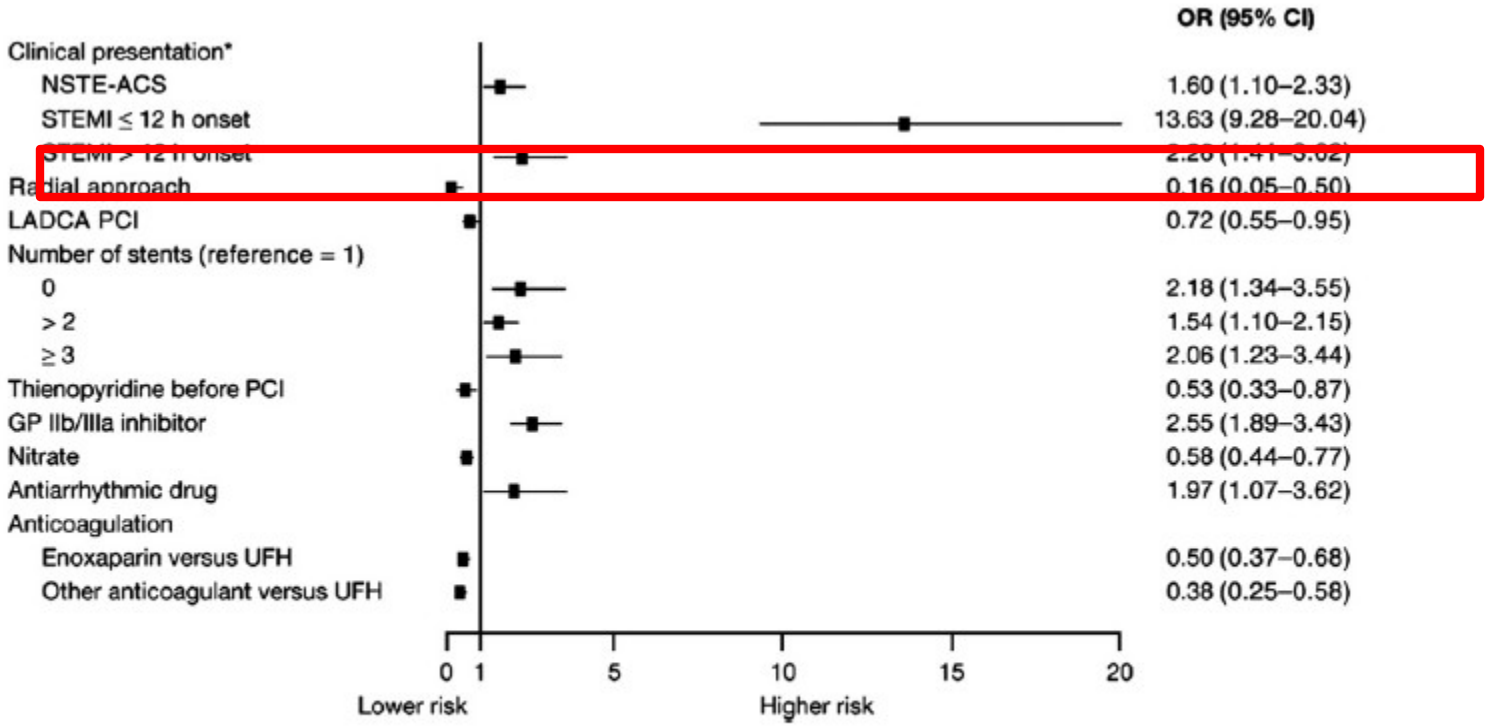


Fig. 1. Independent predictors of death or myocardial infarction. *Reference is asymptomatic or unstable angina. CI, confidence interval; GP; glycoprotein; LADCA, left anterior descending coronary artery; NSTE-ACS, non-ST-segment elevation acute coronary syndrome; OR, odds ratio; PCI, percutaneous coronary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

Montelescot et al, Int J Card 2008; 129(3):

RIVIERA Study: Bleeding

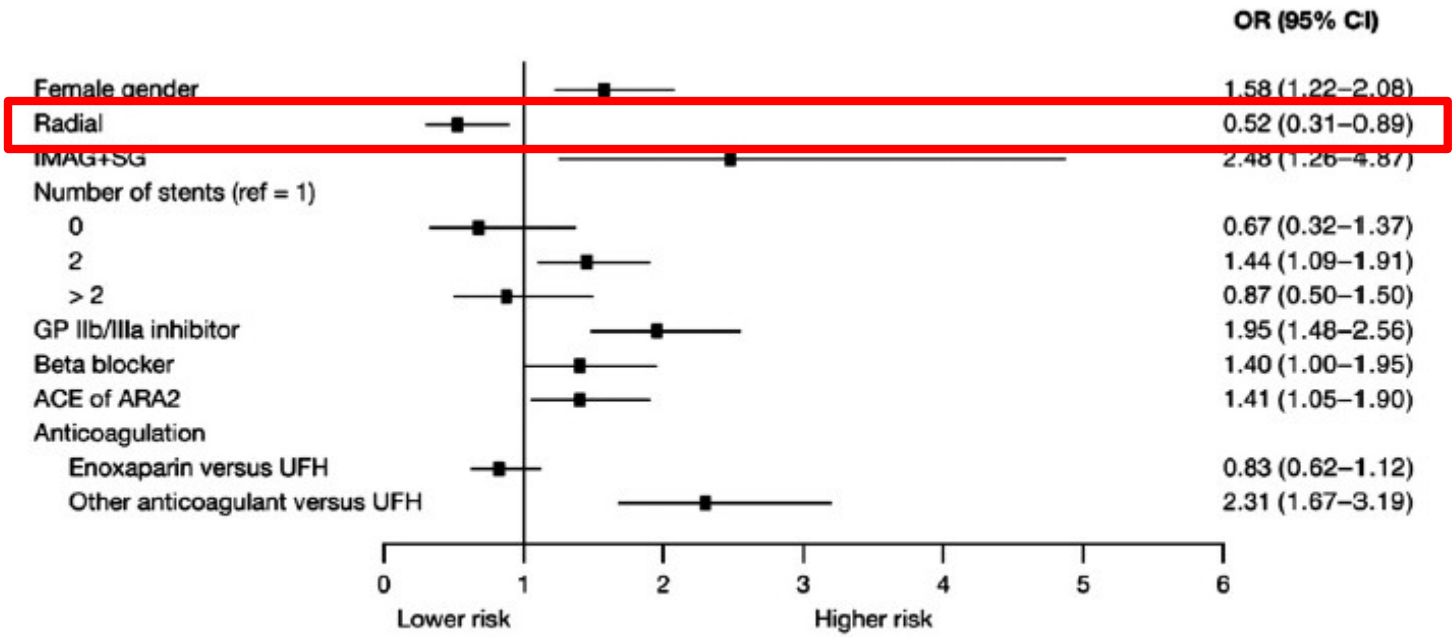


Fig. 2. Independent predictors of bleeding. ACE, angiotensin-converting enzyme; ARA, adenosine receptor antagonist; CI, confidence interval; GP, glycoprotein; IMAG+SG, internal mammary artery graft or saphenous graft; OR, odds ratio; UFH, unfractionated heparin.

Montelescot et al, Int J Card 2008; 129(3):

Mechanisms for Increased Mortality

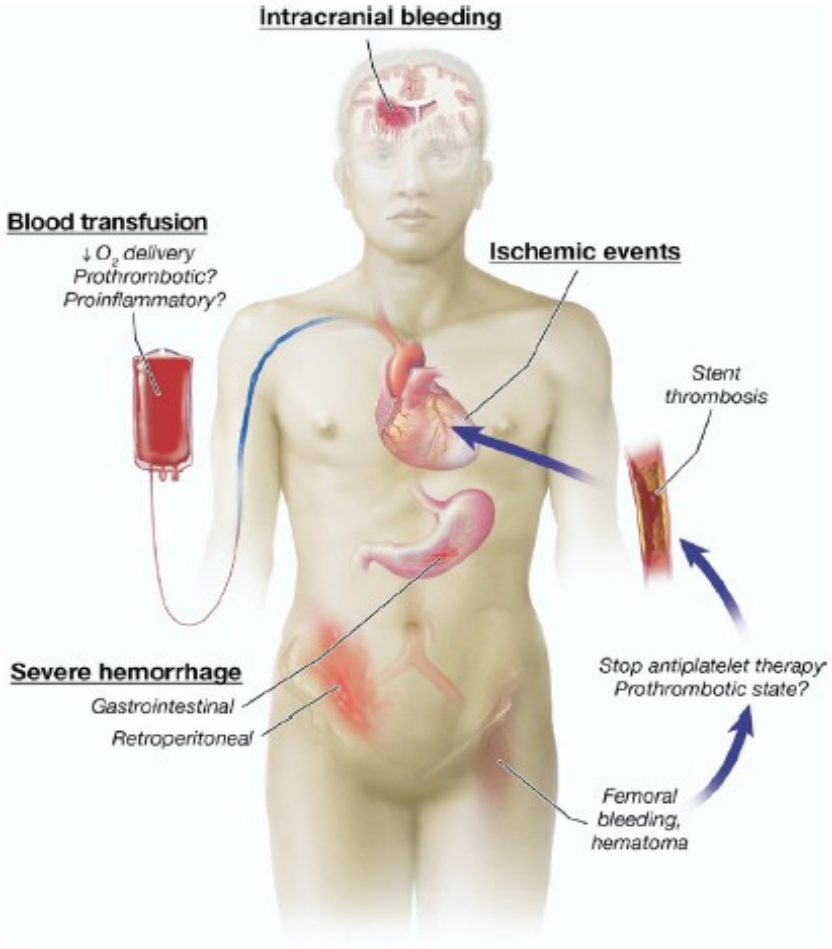


Figure 1 Possible Mechanisms Linking Post-Percutaneous Coronary Intervention Bleeding With Increased Mortality

Figure provided by the Mayo Clinic ©2008.

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

Meta-analysis Radial vs Femoral

- 12 RCTs included spanning 1994-2003 evaluating Coronary Angiography and/or PCI from TR vs TF approach
- Total of 3224 pts
  - 1668 Transradial
  - 1556 Transfemoral
- 7 studies - Diagnostic only
- 5 studies – PCI: of these 2 in ACS/AMI

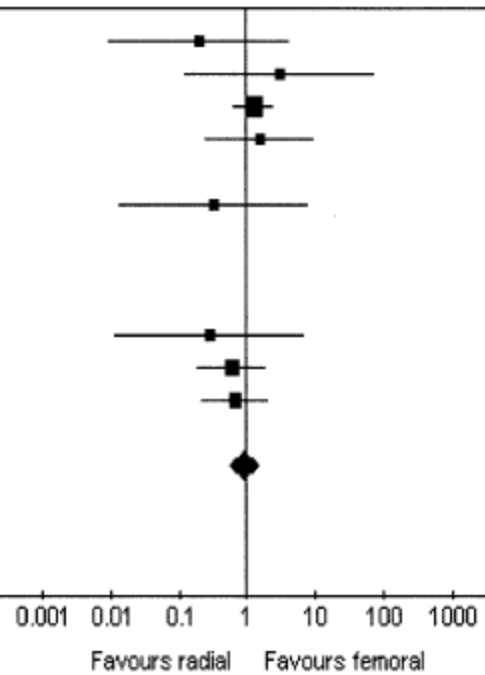
Agostoni et al, JACC 2004; 44: 349-56

Meta-analysis - MACE

Comparison: Radial vs Femoral approach
Outcome: MACE

Study or sub-category	Radial n/N	Femoral n/N	OR (random) 95% CI	Year
Grinfeld	0/138	2/141	0.20 [0.01, 4.23]	1996
Mann 1996	1/76	0/76	3.04 [0.12, 75.80]	1996
ACCESS	20/300	16/300	1.27 [0.64, 2.50]	1997
BRAFE Stent	3/56	2/56	1.53 [0.25, 9.52]	1997
Mann 1998	0/74	0/68	Not estimable	1998
Cooper	0/101	1/99	0.32 [0.01, 8.04]	1999
Monségu	0/196	0/183	Not estimable	2000
CARAFE	0/140	0/70	Not estimable	2001
Gorge	0/214	0/216	Not estimable	2001
Moriyama	0/108	1/92	0.28 [0.01, 6.98]	2002
OCTOPLUS	5/188	8/183	0.60 [0.19, 1.86]	2003
TEMPURA	6/77	8/72	0.68 [0.22, 2.05]	2003
Total (95% CI)	1668	1556	0.92 [0.57, 1.48]	

Total events: 35 (Radial), 38 (Femoral)
Test for heterogeneity: $Chi^2 = 4.43$, df = 7 (P = 0.73)
Test for overall effect: Z = 0.34 (P = 0.73)



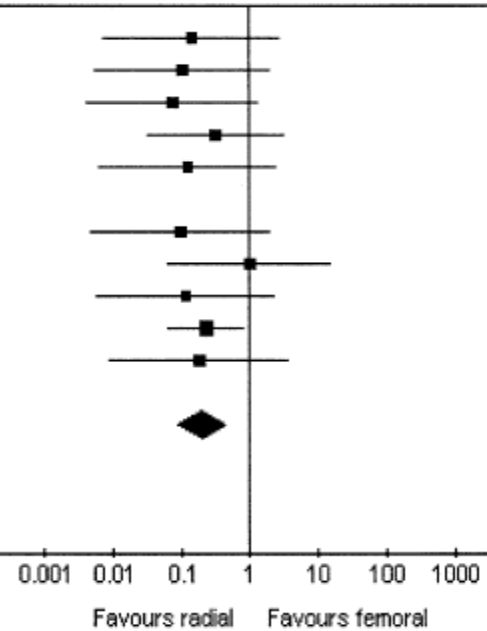
Agostoni et al, JACC 2004; 44: 349-56

Meta-analysis – Entry Site Complications

Comparison: Radial vs Femoral approach
Outcome: Entry site complications

Study or sub-category	Radial n/N	Femoral n/N	OR (random) 95% CI	Year
Grinfeld	0/138	3/141	0.14 [0.01, 2.79]	1996
Mann 1996	0/76	4/76	0.11 [0.01, 1.99]	1996
ACCESS	0/300	6/300	0.08 [0.00, 1.34]	1997
BRAFE Stent	1/56	3/56	0.32 [0.03, 3.19]	1997
Mann 1998	0/74	3/68	0.13 [0.01, 2.48]	1998
Cooper	0/101	0/99	Not estimable	1999
CARAFE	0/140	2/70	0.10 [0.00, 2.06]	2001
Gorge	1/214	1/216	1.01 [0.06, 16.24]	2001
Moriyama	0/108	3/92	0.12 [0.01, 2.31]	2002
OCTOPLUS	3/188	12/183	0.23 [0.06, 0.83]	2003
TEMPURA	0/77	2/72	0.18 [0.01, 3.85]	2003
Total (95% CI)	1472	1373	0.20 [0.09, 0.42]	

Total events: 5 (Radial), 39 (Femoral)
Test for heterogeneity: $Chi^2 = 2.66$, df = 9 (P = 0.98)
Test for overall effect: Z = 4.20 (P < 0.0001)



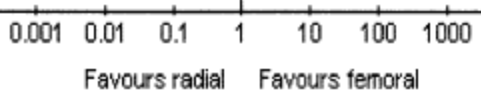
Agostoni et al, JACC 2004; 44: 349-56

Meta-analysis - Procedural Failure

Comparison: Radial vs Femoral approach
Outcome: Procedural failure

Study or sub-category	Radial n/N	Femoral n/N	OR (random) 95% CI	Year
Grinfeld	32/138	7/141	5.78 [2.45, 13.61]	1996
Mann 1996	7/76	3/76	2.47 [0.61, 9.93]	1996
ACCESS	21/300	1/300	22.51 [3.01, 168.42]	1997
BRAFE Stent	6/56	1/56	6.60 [0.77, 56.74]	1997
Mann 1998	9/74	0/68	19.87 [1.13, 348.33]	1998
Cooper	2/101	1/99	1.98 [0.18, 22.19]	1999
CARAFE	1/140	0/70	1.52 [0.06, 37.70]	2001
Gorge	1/214	0/216	3.04 [0.12, 75.09]	2001
Moriyama	8/108	2/92	3.60 [0.74, 17.40]	2002
OCTOPLUS	20/188	17/183	1.16 [0.59, 2.30]	2003
TEMPURA	0/77	1/72	0.31 [0.01, 7.67]	2003
Total (95% CI)	1472	1373	3.30 [1.63, 6.71]	

Total events: 107 (Radial), 33 (Femoral)
Test for heterogeneity: $Chi^2 = 18.71$, df = 10 (P = 0.04)
Test for overall effect: Z = 3.31 (P = 0.0009)



Agostoni et al, JACC 2004; 44: 349-56

Meta-analysis: Secondary Endpoints

- Significant heterogeneity
  - Fluoroscopy time shorter for Femoral
    - TFA – 7.8 min vs TRA – 8.9 min
      - (Diff: 1.05, 95% CI diff: 0.51 to 1.60, $p < 0.001$)
  - Mean hospital stay shorter for Radial
    - TFA – 2.4 days vs TRA – 1.8 days
      - (Diff: 0.55, 95% CI diff: 0.29 to 0.82, $p < 0.001$)
  - Total hospital charge lower for Radial

Agostoni et al, JACC 2004; 44: 349-56

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, $p = 0.29$)

Jolly et al, Am Heart J 2009; 157: 132-40)

Radial PCI in STEMI

- Single center longitudinal cohort study
- 530 patients with STEMI undergoing primary PCI < 12hrs enrolled in registry
- Access: chosen at discretion of operator
- Default access = Radial, with Femoral access used if unfavorable Allen test or h/o CABG
- Baseline characteristics:
  - Radial group more likely to be older, male, higher BMI, less likely to have prior MI

Azmendi et al, Am J Card 2010; 106(2): 148-154

Radial PCI in STEMI - MACE

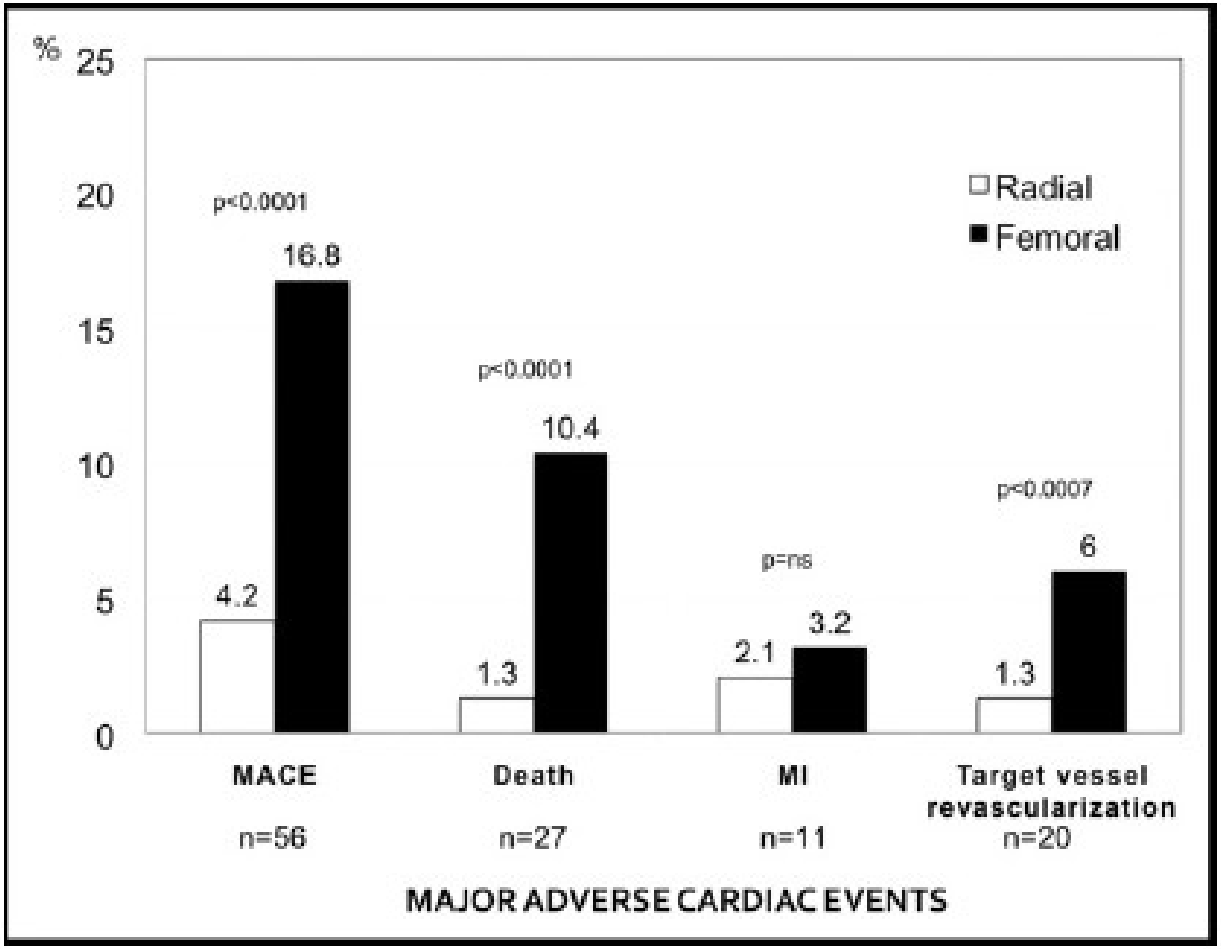


Figure 1. MACE at 1 year of follow-up. Chart labels represent percentages of each event. Data in axis represent absolute value of each event.

Azmendi et al, Am J Card 2010; 106(2): 148-

Transradial disadvantages

- Longer procedure time
- Increased door to balloon time in STEMI pts
- Radial artery occlusion/lack of conduit
- Increased radiation exposure for patient/staff/physicians

From brachial to Transfemoral approach

- Dominant strategy since Dr Melvin Judkins
- Large vessels
- Preformed catheters
- Avoided cutdowns (Brachial artery Sones)
- Could tolerate larger catheter size
- Could be repeated
- Percutaneous
- Anatomy straightforward

Transfemoral potential pitfalls

- Entry site critical
- Landmarks sometimes very problematic
- The Red Sea
- Space for unrecognized blood collections
- Hemostasis
- Peripheral arterial disease

Door-to-Balloon time

- Single-center observational study 2005-9
- 4 PCI operators
  - 1 preferred TF, 1 preferred TR, 2 no preference – all trained in both
- 240 consecutive STEMI cases
- 205 undergoing successful PCI
  - 124 trans-radial
  - 116 trans-femoral

Weaver et al, CCI 2010; 75: 695-699

Door-to-Balloon time

TABLE II. Procedural and Process Times Measured from Door to Balloon

	Radial (n = 124)	Femoral (n = 116)	P value
Door to ECG (min)	9.1 ± 9.3	9.9 ± 10.3	0.55
ECG to HA (min)	5.5 ± 6.7	7.9 ±11.5	0.05
HA activation to team arrival (min)	22.5 ± 11.9	23.1 ± 10.1	0.68
Team arrival to patient arrival in lab (min)	11.6 ± 6.6	13.3 ± 7.5	0.07
Arrival in cath lab to balloon inflation (min)	28.4 ± 11.3	32.7 ± 12.4	0.01
Case start to access time (min)	12.5 ± 5.4	10.5 ± 5.7	0.005
Time from access to balloon inflation (min)	18.3 ± 10.8	24.1 ± 11.7	<0.001
Door to balloon time (min)	76.4 ± 26.4	86.5 ± 27.6	0.008
Number of total coronary catheters used (min)	2.9 ± 1.0	3.1 ± 0.8	0.02
Fluoroscopy time (min)	12.5 ± 7.9	15.2 ± 10.1	0.02
Contrast given (mL)	168.5 ± 66.6	186.7 ± 68.2	0.04

ECG = electrocardiogram, HA = heart alert.

Weaver et al, CCI 2010; 75: 695-699

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

TABLE II. Fluoroscopy Time and Radiation Measurements

	Femoral	Radial	*P*
Coronary angiography (n)	103	92	
Fluoroscopy time (min)	1.7 ± 1.4	2.8 ± 2.1	< 0.001
Dose-area product (Gy · cm^2)	13.1 ± 8.5	15.1 ± 8.4	< 0.05
Radiation exposure (μSv)[a]	32 ± 39	64 ± 55	< 0.001
Percutaneous intervention (n)	48	54	
Fluoroscopy time (min)	10.4 ± 6.8	11.4 ± 8.4	NS
Dose-area product (Gy · cm^2)	51.0 ± 29.4	46.3 ± 28.7	NS
Radiation exposure (μSv)[a]	110 ± 115	166 ± 188	< 0.05

- Potential for increased radiation exposure both to patient and operator
- Close attention to techniques and precautions for minimizing exposure needed

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

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%

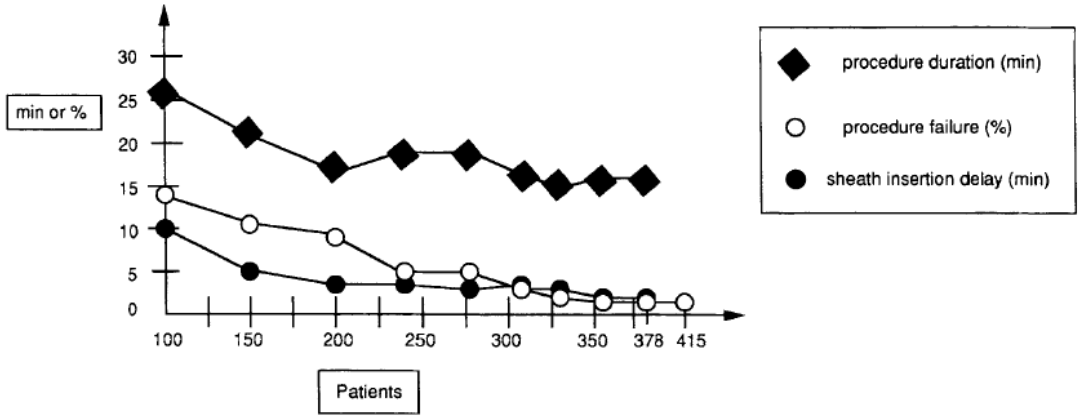
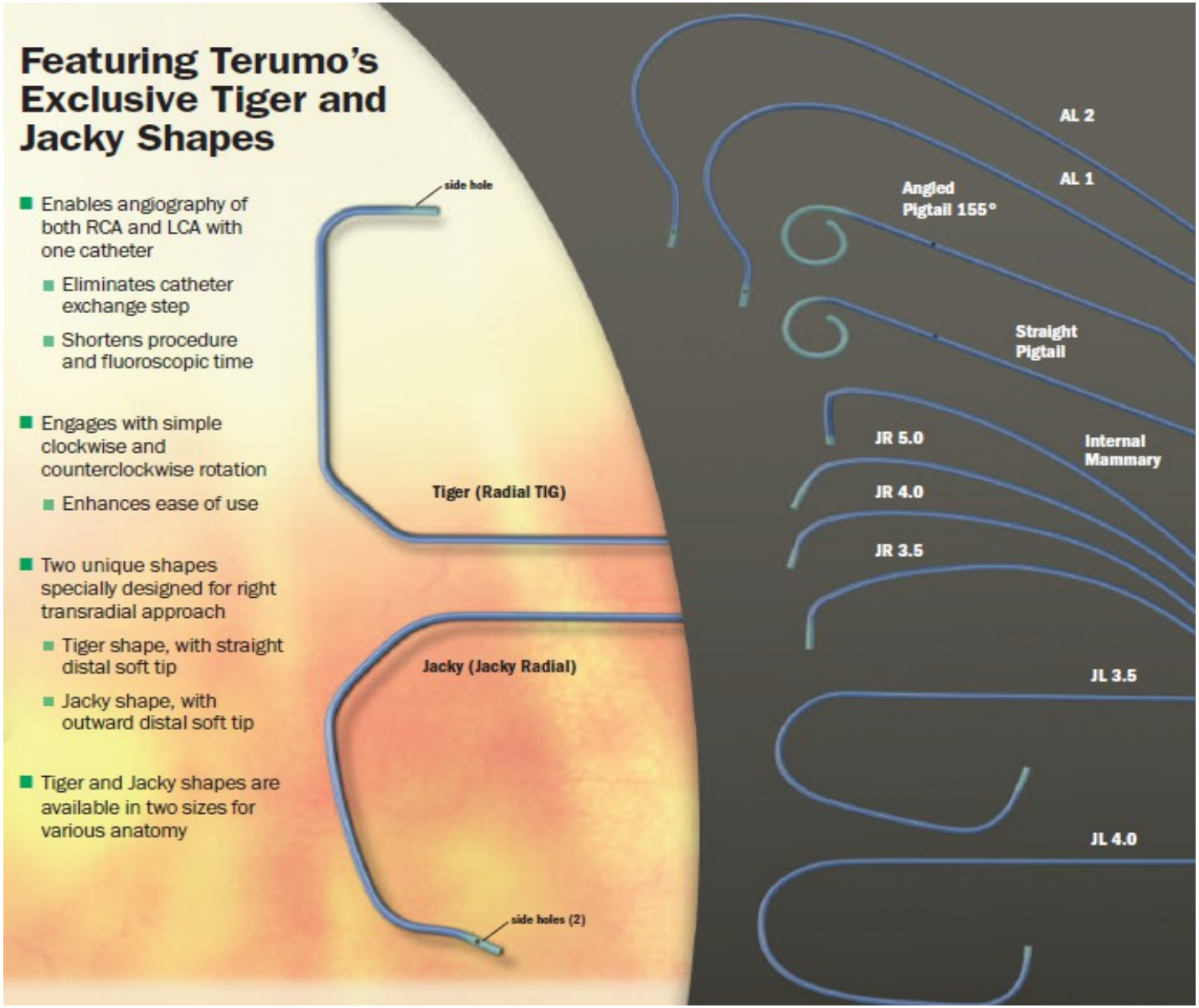


Fig. 5. Learning curve procedure failure rate, sheath insertion delay, and procedure duration.

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

Catheters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Two unique shapes specially designed for right transradial approach
Tiger shape, with straight distal soft tip
Jacky shape, with outward distal soft tip
Tiger and Jacky shapes are available in two sizes for various anatomy
side hole
Tiger (Radial TIG)
Jacky (Jacky Radial)
side holes (2)
AL 2
AL 1
Angled Pigtail 155°
Straight Pigtail
JR 5.0
Internal Mammary
JR 4.0
JR 3.5
JL 3.5
JL 4.0

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- Soft tip
  - Atraumatic to coronary ostium
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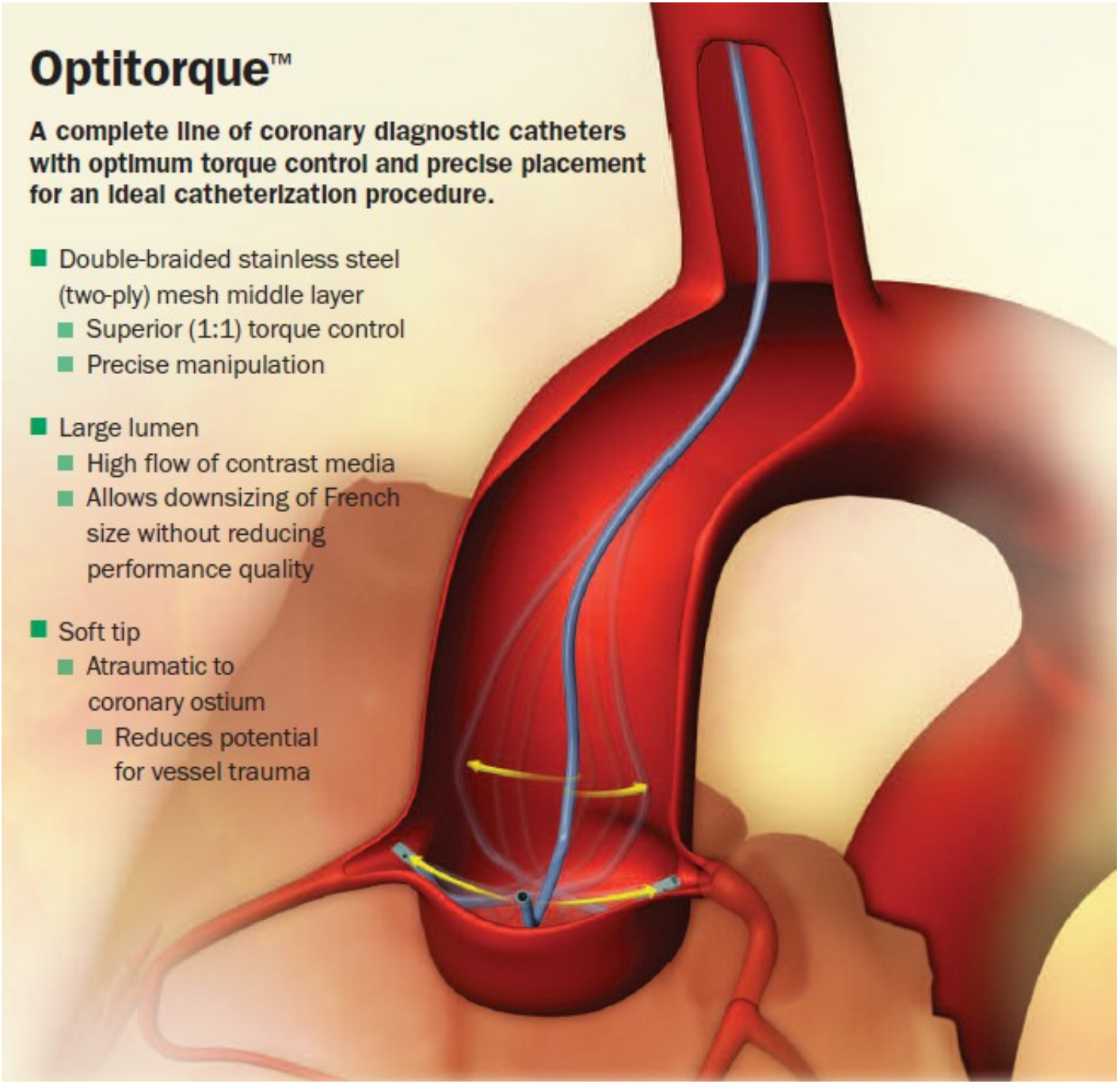

Transradial benefits

- Reduces the risk of bleeding complications, swelling and back pain, especially in women, obese patients, elderly patients and those with peripheral vascular disease (PVD)
- Has better first-time success rates for accessing arteries in obese patients and patients with PVD
- Improves patient outcomes and overall experiences
- Enables patients to be mobile almost immediately after the procedure

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
- High success rates after initial learning curve period

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