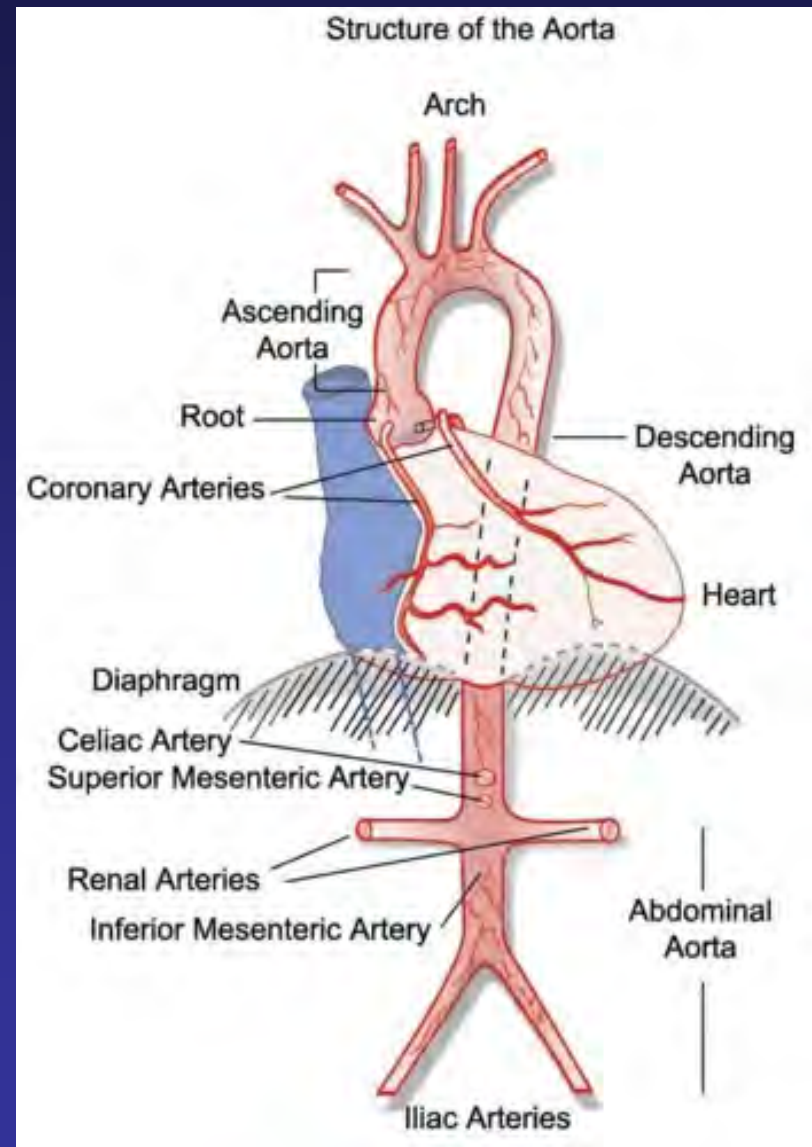
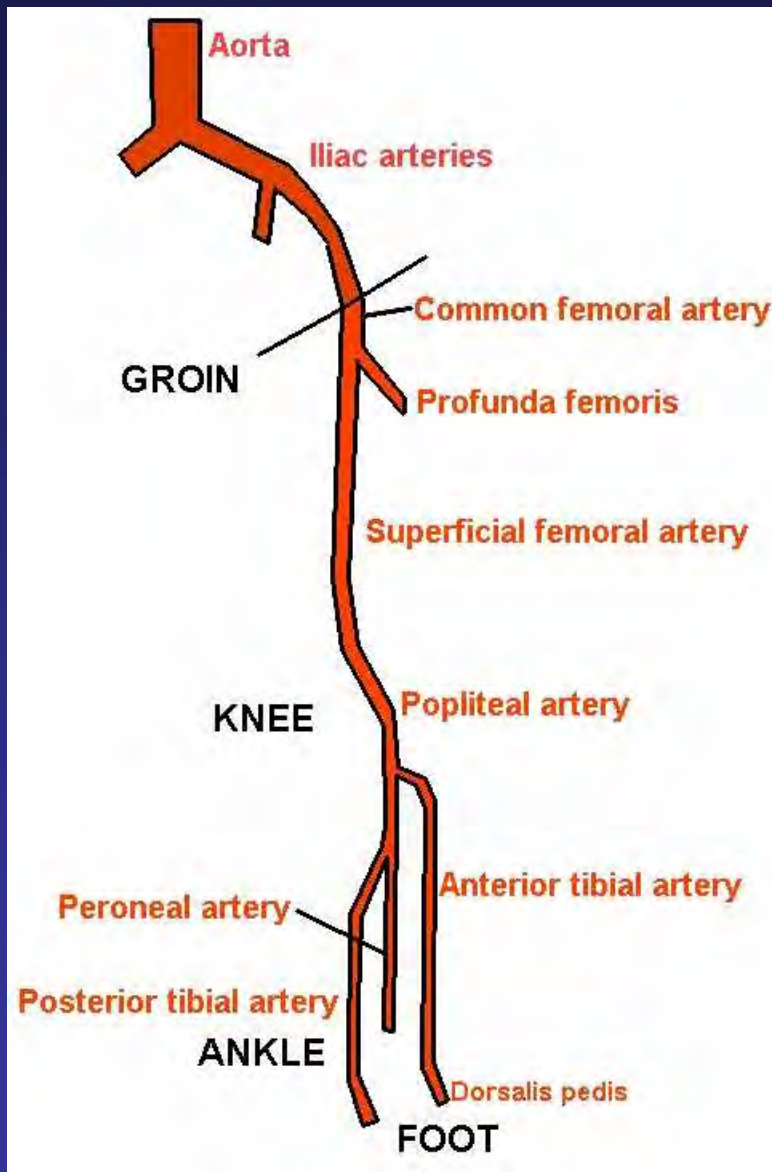


Radial Approach

או למה לעבור מאוטוסטרדה לשביל עיזים?

Aharon Frimerman MD
Hillel-Yaffe Medical Center
Hadera





Femoral Access: Complications

- **Major:**
Requiring transfusion or surgical repair
 - ✱ occurs in 2-4%* of interventions

- **Other measures of vascular complications:**
 - ✱ TIMI bleeding rates
 - Major
 - Minor

*J Am Coll Cardiol 1998;32:572-6.

*J Am Coll Cardiol 1997;29:1269-75.

†NEJM 1997;336:1689-96.



Vascular Complications In PCI

- **Pseudo-aneurysm**

- AV fistula, infection, deep vein thrombosis

- **Arterial occlusion**

- dissection, embolism, thrombosis

- **Bleeding (in PCR)**

- minor 0.37 % (up to 14 %*)
- major, requiring sx or transfusion 1.05 % (2- 4 % *)
- Retro-peritoneal hemorrhage

- * worse with adjunctive pharmacotherapy

Vascular Complications In PCI

- » Risk Factors for Vascular Complications
 - old age
 - female gender
 - high grade atherosclerosis at the access site
 - obesity
 - arterial hypertension
 - adjunctive pharmacotherapy
 - ASA, Heparin, coumadin, IIb/IIIa- inhibitors

Pseudoaneurysm

- **Etiology**
 - ✦ **Hematoma formation with persistent flow into the hematoma**
- **Diagnosis: painful pulsatile mass, new bruit, and ultrasonography**
- **Management**
 - ✦ **Ultrasound-guided compression**
 - ✦ **Ultrasound-guided thrombin injection**
 - ✦ **Surgery**



Retroperitoneal Hemorrhage

- **Etiology**
 - * **Bleeding into the retroperitoneal space**
- **Management**
 - * **Diagnose with CT scan from diaphragm to thigh**
 - * **Treatments: compression, transfusion, surgery or balloon tamponade**



Hematoma

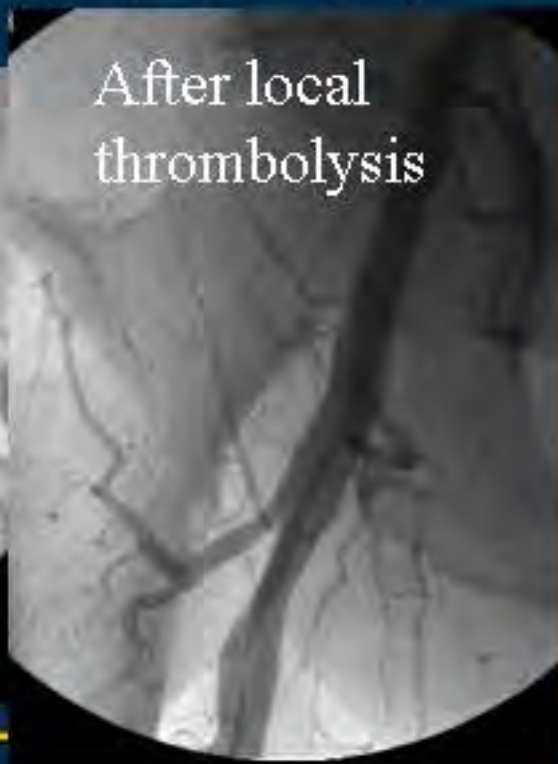
- **Risk factors**
 - * **Obesity**
 - * **2b3a utilization***
 - * **Systemic anticoagulation†**
- **Management: Compression, transfusion, avoid draining or surgery**

* Epic NEJM 1994;330:956.
EpiLog NEJM 1997;336:1689.
Pursuit NEJM 1998;339:436.

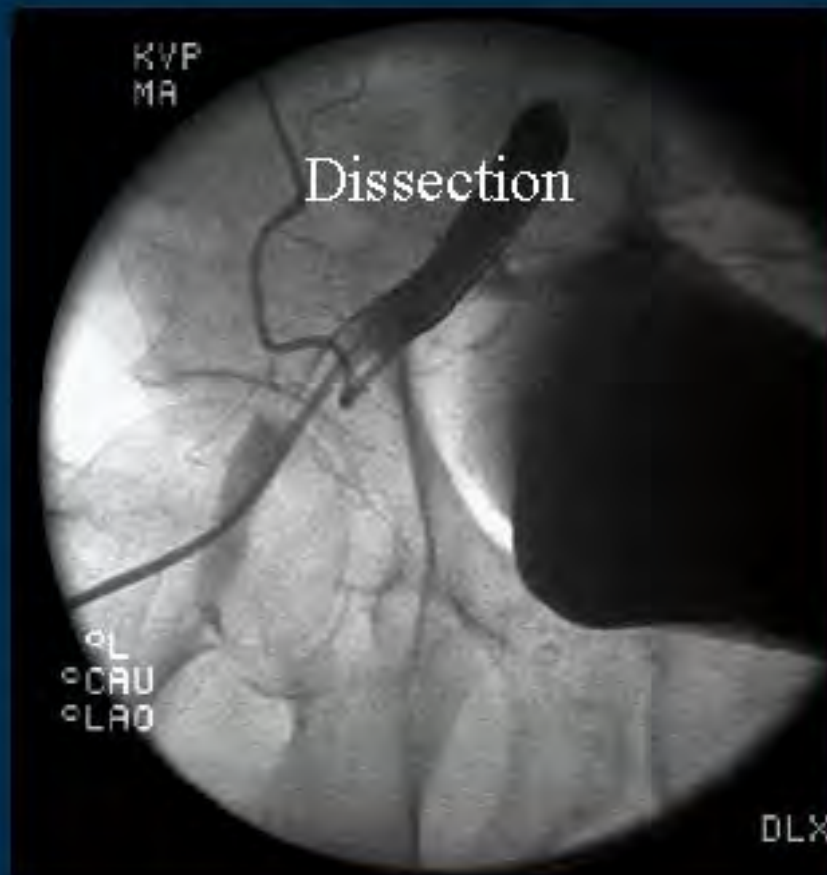


Thrombosis

- **Etiology**
 - * Embolized thrombus from sheath or on catheter
 - * Thrombosis of dissection flap or on stenosis
- **Treatment**
 - * Angioplasty, local thrombolysis, Angiojet, surgery



Dissection



Dissection

* **Retrograde lifting of intima or atherosclerotic plaque**

* **Treatment:**

- **Conservative**
 - non-flow limiting
- **Angioplasty**
 - flow limiting in common femoral or iliacs
- **Stenting**
 - flow limiting in iliacs
- **Surgery**



Stenosis formation

- **Stenosis formation**
 - * **Early:**
 - **dissection**
 - **malposition of closure device**
 - * **Late:**
 - **Scarring**
 - **Dissection**
 - **closure malposition**



**הוצאת צינורית הגישה לעורק במפשעה תוך לחץ
ממושך ולאחריו שכיבה ממושכת ללא תזוזה**

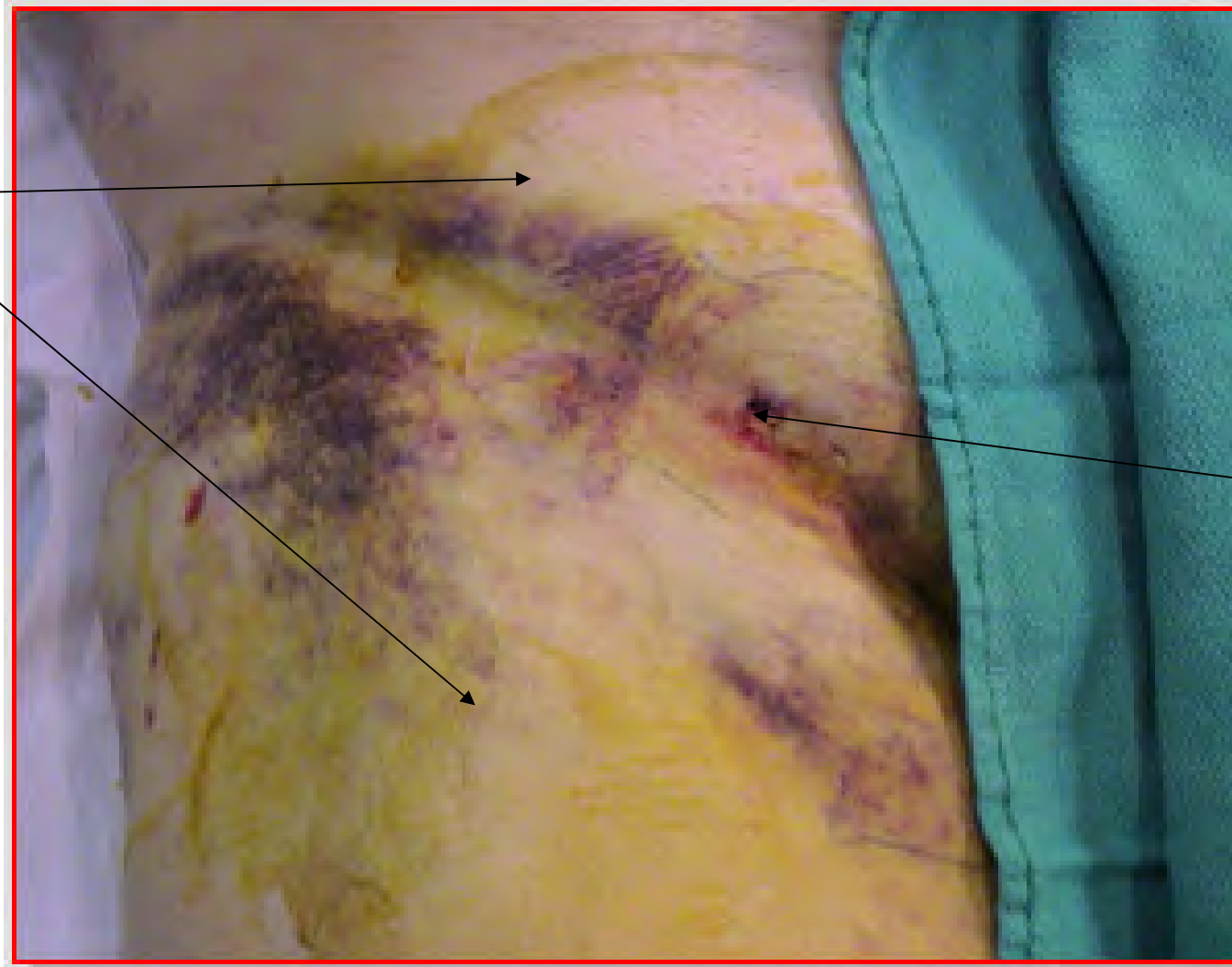


**מכשיר ללחיצה על העורק
לשם מניעת דימום**

אתר הכניסה לעורק

מסיבוכי הגישה דרך עורק במפשעה: דימום

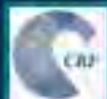
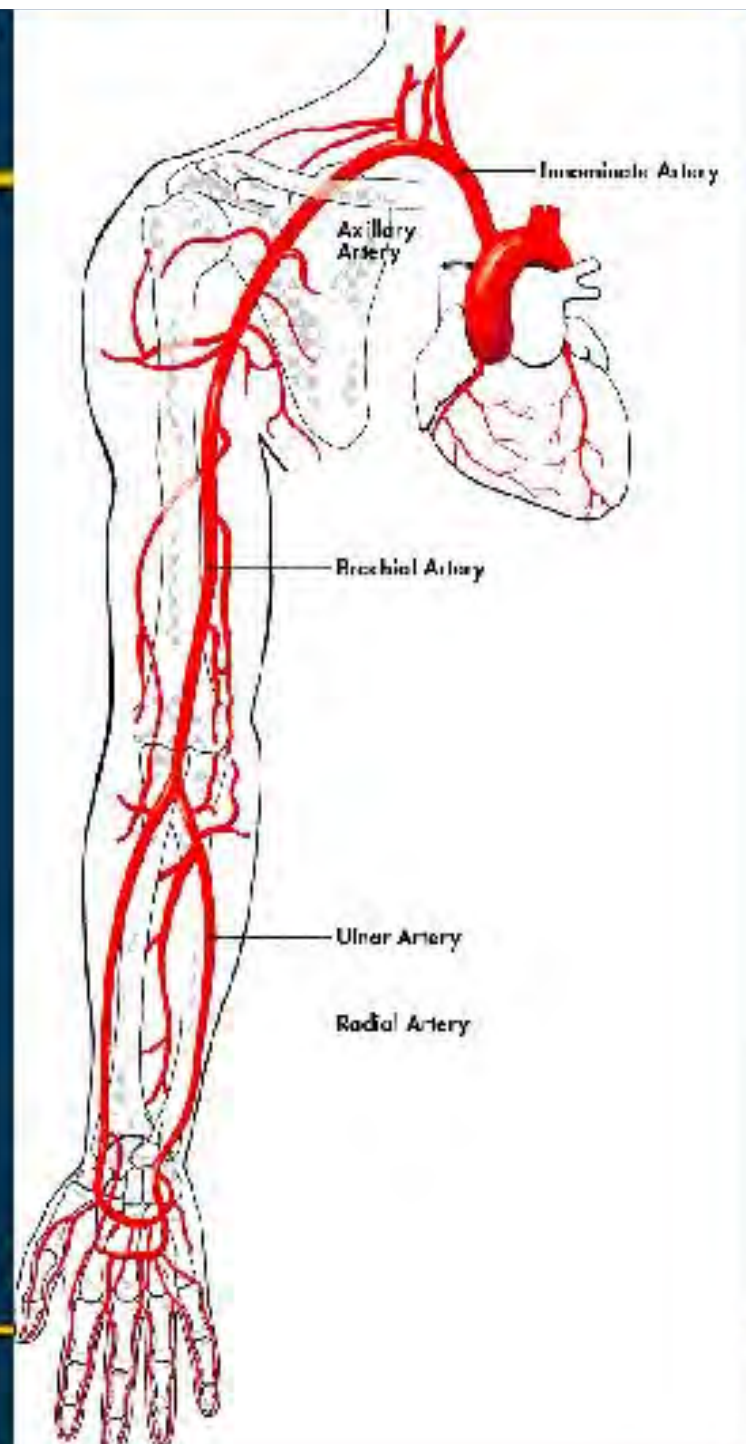
דימום



נקודת
הכניסה
לעורק
במפשעה

Radial Anatomy

- **Dual circulation to the hand**
 - * Collateralized with palmar arches
- **Flat bony prominence at access site**
 - * Radius proximal to styloid process
- **No major nerve associated with artery**
 - * Median nerve in carpal tunnel
 - * Ulnar nerve with ulnar artery



Radial Loop

Recurrent
Radial Artery



Radial Loop

Radial Artery





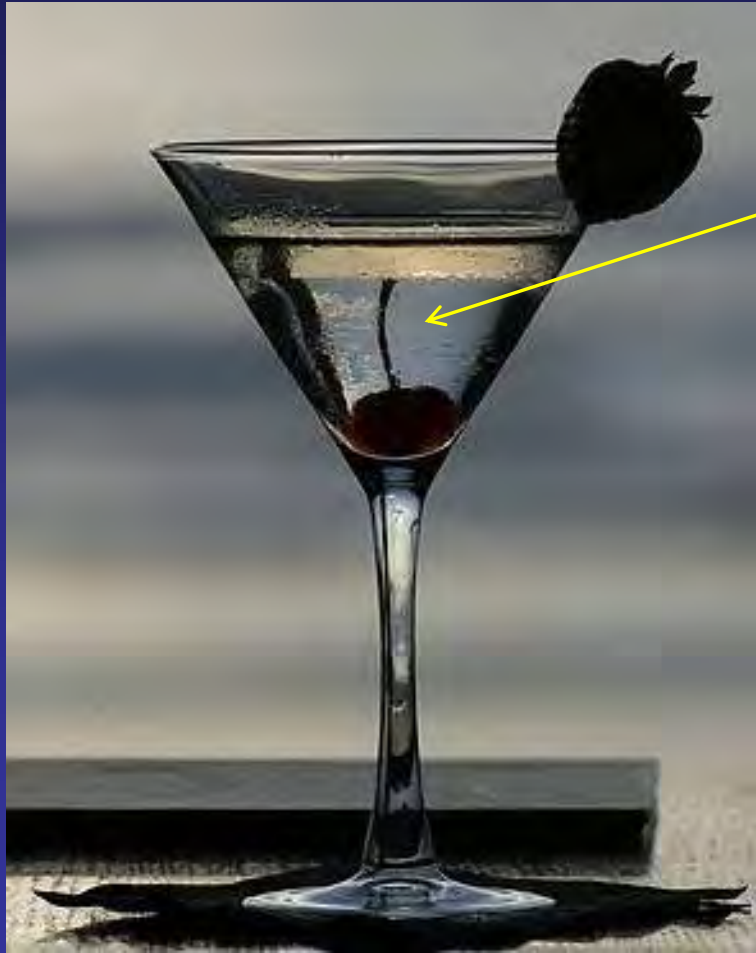
"שביל עיזים" עם הרבה הפתעות בדרך

- עורק "קפריזי"
- דק בקוטרו, קנולציה קשה
- מתפתל, הרבה וריאציות אנטומיות, לעיתים זווית כניסה קשה לקשת האורטה
- ניווט קטטר שונה מאשר בגישה הפמורלית, דורש מיומנות רבה לעיתים "אקרובטית"
- נטייה לספאזם
- נטייה לטרומבוזיס

כיצד ננווט ב"שביל העיזים" ונשמור עליו מפגעים?

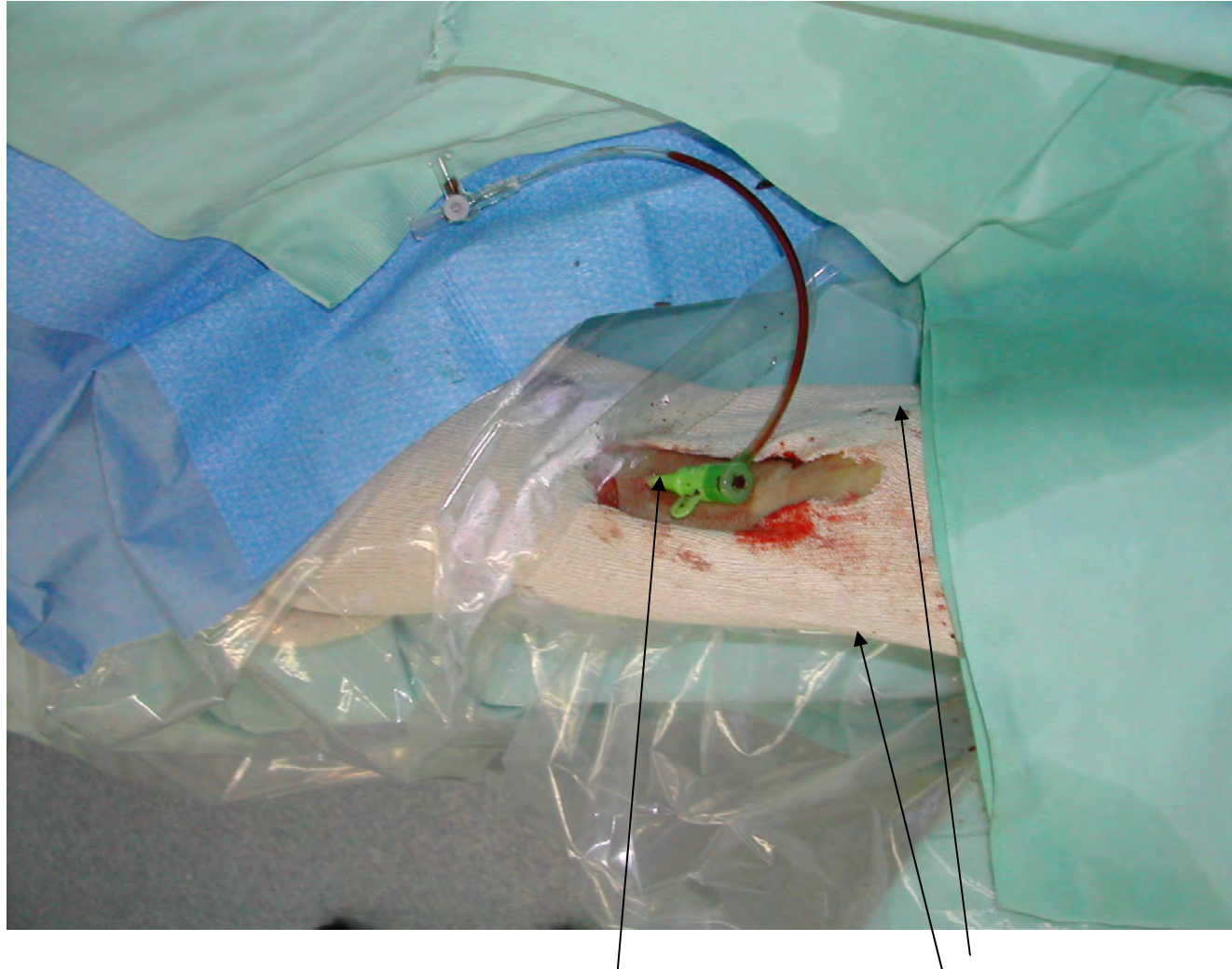
"קוקטיל" תרופתי לתוך
העורק הכולל:

Verapamil
Nitro
Heparin



ציוד מיוחד: שרוולית
עורקית, תיילים מנחים,
קטטרים ייעודיים.
הרבה סבלנות נחישות
ורגישות.
עקומת לימוד ממושכת

כניסה לעורק בשורש כף היד (עורק רדיאלי)



נקודת הכניסה לעורק הרדיאלי עם צינורית בעלת שסתום חד כיווני דרכה מוחדרים הקטטרים ללב

כף היד

**בתום הפעולה הצינורית דרכה הוחדרו הקטטרים ללב
נשלפת מיידית מהעורק ונקודת הכניסה נחבשת**



חבישה

**הצינורית
דרכה הוחדרו
הקטטרים ללב
מחוץ לעורק**

המתופל יכול לקום על רגליו ואינו מוגבל לשכיבה ממושכת

איזור הכניסה
לעורק ומשם ללב



התחבושת מוסרת אחר מספר שעות



איזור הכניסה לעורק שיעבור ריפוי מלא

Radial access

- **Major vascular complications <0.1%***
 - ✱ **Bleeding rarely**
- **Access failure: 3-7%**
 - ✱ **Major limitation of radial access**
 - ✱ **Predictors include:**
 - ✱ **Female gender**
 - ✱ **Small vessel size**

Mann, JACC 1998;32:572-6

Kiemeneij, JACC 1997;29:1269-75.

Cooper, Am Heart J 1999;138:430-6.



Avoiding radial occlusion

- **Heparin during the procedure ***

Heparin Dose	Occlusion Rate
0	71%
2-3,000	24%
5,000	4.3%

- **Gender ***
 - ✱ Female: **80%**
 - ✱ Male: **18%**
- **Vessel size < sheath size †**
- **Diabetes †**

* *European Heart Journal* 1995;16:293.

† *Cathet Cardiovasc Intervent* 1999;46:173. *Am J Cardiol* 1999;83:180.



Why I Prefer the Radial Approach

Very low rate of complications

Pasteur TRA for PCI: 10 years experience

- **Access site complications**

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

Why I Prefer the Radial Approach

Very low rate of complications

Transradial Artery Coronary Angioplasty

F. Kiemeneij et al. Am Heart J 1995; 129: 1-7

Vascular access site complications

100 patients, 122 lesions

Major hematoma	= 0	
Pseudo aneurysm	= 2	
AV fistula	= 0	
Vascular repair	= 0	
Blood transfusion	= 0	
Loss of radial pulse	= 10	< all asymptomatic 5 recanalizations at F/U

Why I Prefer the Radial Approach

Very low rate of complications

Major vascular complications

Access Site	Complication Rate
• Femoral with:	
* Compression	2-4%
* Perclose	2.4%
* Vasoseal	1.2-2.8%
* Angioseal	1.2%
* Duett	2.5%
• Brachial	2-3%
• Radial	0.1%

Vasoseal Sanborn JACC 1993;22:1273.

Vasoseal Ernst JACC 1993;21:851.

Perclose Baim, Stand-II AHA 1997.

Radial Kiemeniej, JACC 1997;29:1269-75.

Angioseal Cremanesi, J Invas Cardiol 1998;10:464.

Angioseal Kussmaul JACC 1995;25:1685.

Radial Mann, JACC 1998;32:572-6.

Duett Ellis Circ 1999;100:I-513.

Why I Prefer the Radial Approach

Very low rate of complications

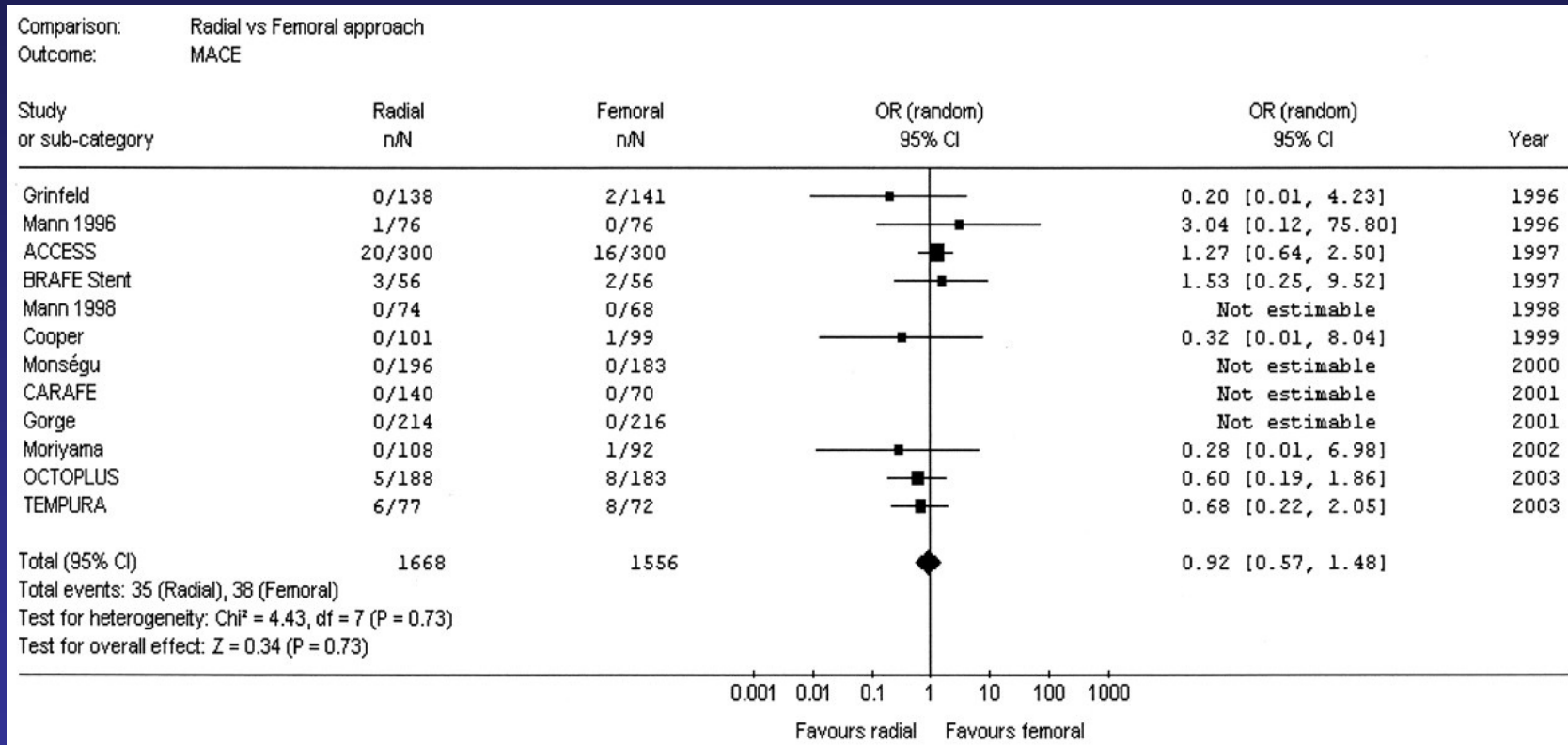
**Access Bleeding Complications*:
Coronary stenting in 518 patients
10/99-3/01**

	<u>Radial</u>		<u>Femoral</u>				
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>			
Gp I: Plavix Pre-PCI	55	0	-	45	2	4.4%	
Gp II: Abciximab	78	0	-	68	6	9%	p<.01
Gp III: Pavix Post-PCI	118	0	-	154	3	2%	
	251	0	0%	267	11	4.1%	p<.01

*** DEFINED AS ANY BLEEDING THAT PROLONGS HOSPITALIZATION**

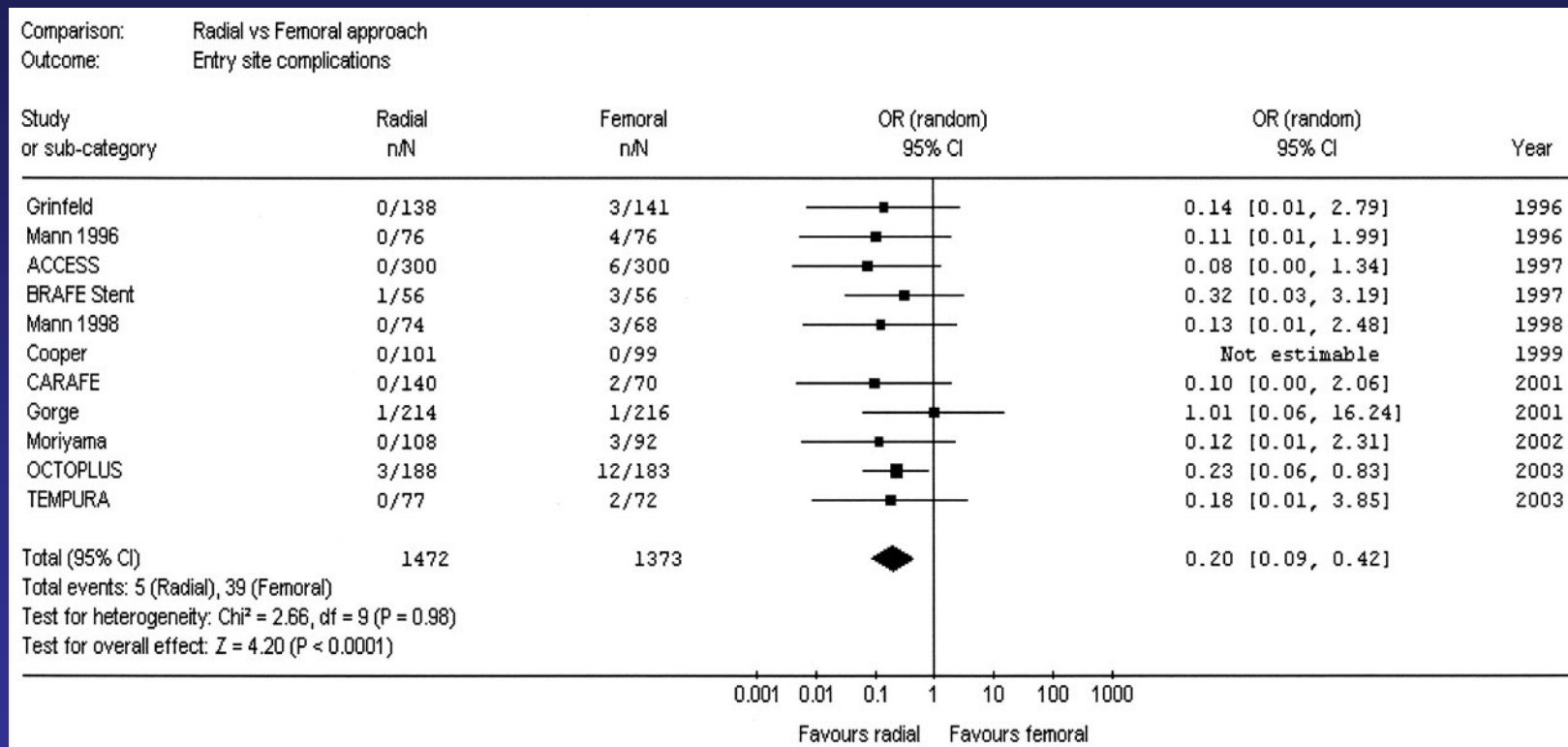
Radial VS Femoral approach

MACE (Death, MI, TVR)



Agostoni P Et Al:Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures; Systematic overview and meta-analysis of randomized trials.*J Am Coll Cardiol.* 2004 Jul 21;44(2):349-56 (12 randomized trials 3224 patients).

Radial VS Femoral approach Entry site complications



Agostoni P Et Al:Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures; Systematic overview and meta-analysis of randomized trials. *J Am Coll Cardiol.* 2004 Jul 21;44(2):349-56.

תפוצת הגישה הרדיאלית בעולם ובארץ

- ארה"ב: 1.3% מהמקרים
 - אירופה: 20-30% מהמקרים
 - המזרח הרחוק, יפן: 40% מהמקרים
 - ישראל: כ 10% מהמרכזים הרפואיים כרוטינה (סורוקה, זיו). באחרים כפעולה ספורדית באינדיקציות נבחרות
 - הלל יפה: ברירת המחדל, מעל 90% מהמקרים.
- גישה פמורלית רק אחרי CABG, חולה קשה ולא יציב,
לא ניתן להכנס לעורק הרדיאלי

Radial-access PCI rarely performed in US but associated with 58% less bleeding than femoral PCI

Study population: 593 094 patients who underwent PCI between January 2004 and March 2007. Of those, 1.32% were treated using radial-artery access.

Despite the limited use of radial PCI during the period, the approach was associated with a similar rate of success and a 58% lower risk of bleeding complications. The reduction in bleeding was even more pronounced among women, the elderly, and patients undergoing PCI for acute coronary syndrome.

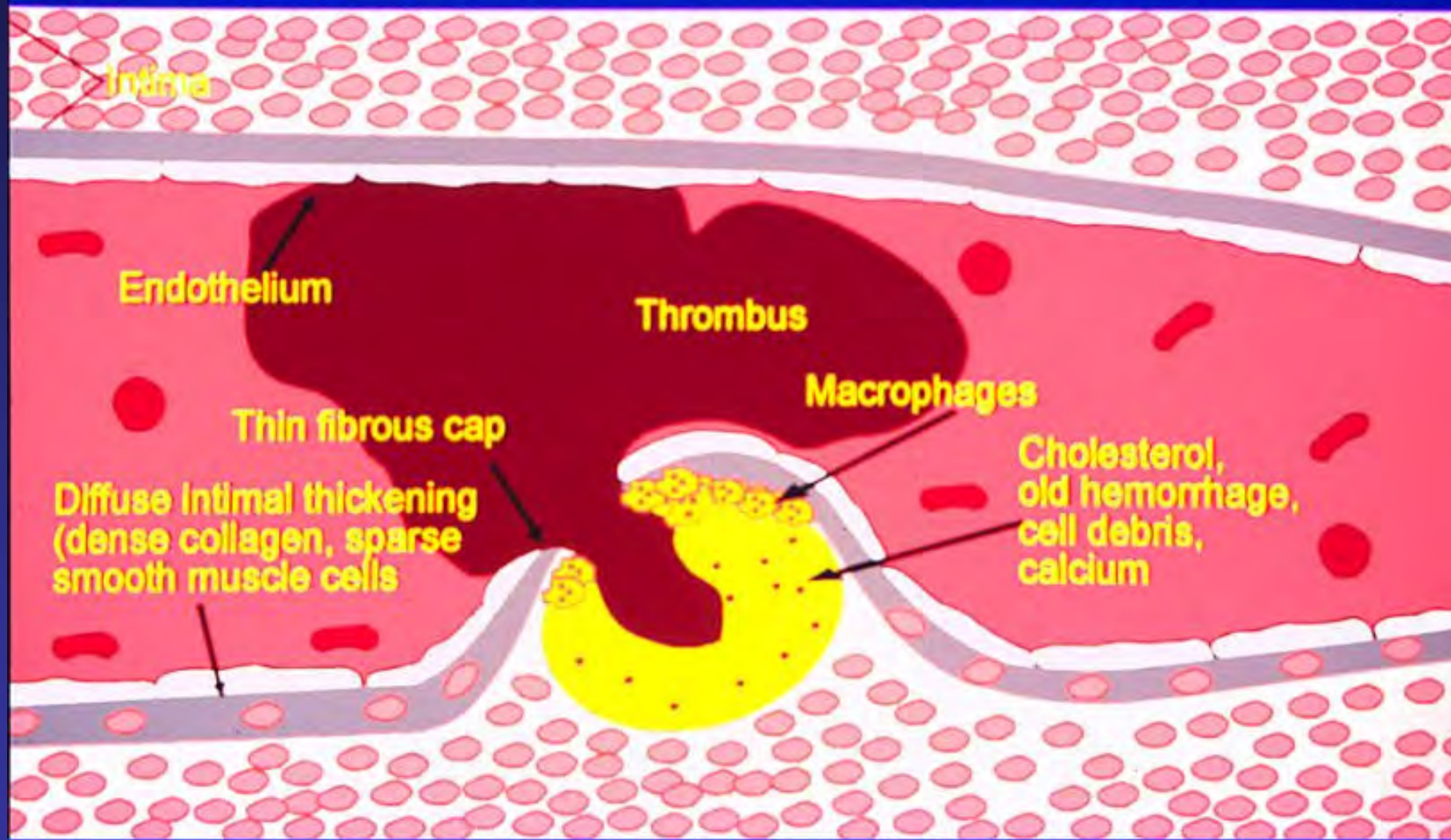
JACC Intervention 8/08

Outcome	Adjusted odds ratio (95% CI)
Procedural success	1.02 (0.92-1.12)
Any bleeding complication	0.42 (0.31-0.56)

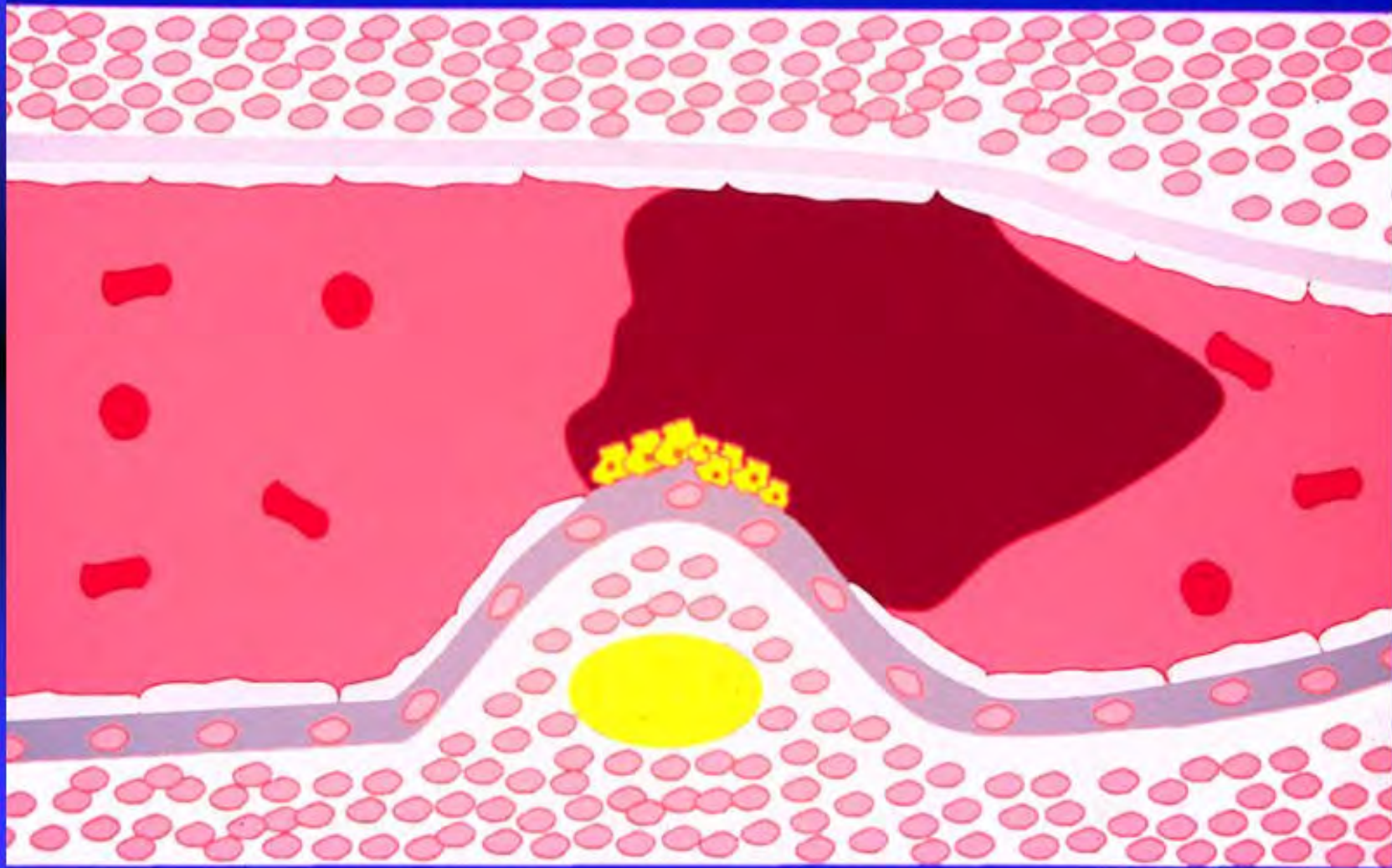
TRA, PCI, PRIMARY PCI, and BLEEDING

- TRA: Trans Radial Access
- TFA: Trans Femoral Access
- PCI: Percutaneous Coronary Intervention
- PPCI: Primary PCI for STEMI

Anatomy of 60% of Fatal Myocardial Infarctions: Rupture



Anatomy of 30% of Fatal Myocardial Infarctions: Erosion



TRA, PCI, PRIMARY PCI, and BLEEDING

- Anti aggregation therapy during PPCI:
Aspirin, Plavix, Anti 2b3a (ReoPro, Integrilin, Aggrastat).
- Anti coagulation therapy during PPCI:
Heparin, Clexane, Bivalirudin,
- Sometimes thrombolytic therapy on board!
- Sometimes the patient is on Coumadin

Mortality closely tied to major bleeds at primary PCI

HORIZONS-AMI (9/08): >3600 patients getting PCI for acute ST-segment-elevation MI (STEMI) randomized to get **bivalirudin or unfractionated heparin (UFH) plus a glycoprotein IIb/IIIa inhibitor**

Hazard ratios^a (HR) for primary-end point components as predictors of **30-day mortality** in HORIZONS-AMI multivariate analysis

End point	HR (95% CI)	p
Reinfarction	9.13 (2.62-31.85)	<0.001
Stroke	2.65 (0.74-9.43)	0.13
Ischemia-driven TVR	1.15 (0.31-4.20)	0.83
Major bleeding ^b	5.08 (3.10-8.35)	<0.001

Major non-CABG-related bleeding as well as reinfarction were both significant predictors of 30-day all-cause mortality in the trial, independent of baseline features and all other clinical events. A major bleeding event, on its own, raised the mortality risk by a factor of up to five (p<0.001), depending on the analysis.

Mortality closely tied to major bleeds at primary PCI

Pooled analysis from three major **bivalirudin** trials—**REPLACE-2, ACUITY, and HORIZONS: PCI during ACS-STEMI** (from the last four years)

Independent hazard ratio of non-CABG-related major bleeding and MI within 30 days on mortality within one year

Event	Hazard ratio (95% CI)	Deaths within 1 y, n	p
Non-CABG major bleed	3.1 (2.4-3.9)	104	<0.001
MI	2.8 (2.2-3.6)	77	<0.001

Data presented at the **European Society of Cardiology 9/09 Congress-Barcelona**

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		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		4.7	30-day OR: 7.55 [4.68–12.18]	<0.0001
Kim et al. (5)	6,799	Unselected	Yes		8.0	1-year RR: 2.03 (transfused patients)	0.0028
Doyle et al. (6)	17,901	Unselected	Yes		4.8	30-day adjusted HR: 9.96 [6.94– 14.3]	<0.0001
GRACE registry (7)*	24,045	ACS	Yes		3.9	In-hospital adjusted OR: 1.64 [1.18–2.28]	<0.0001
Yatskar et al. (8)	6,656	Unselected	Yes		1.8	In-hospital adjusted OR: 3.59 [1.66–7.77]	0.001
Doyle, B. J. et al. J Am Coll Cardiol 2009;53:2019-2027						1-year adjusted HR: 1.65 [1.01– 2.70]	0.048

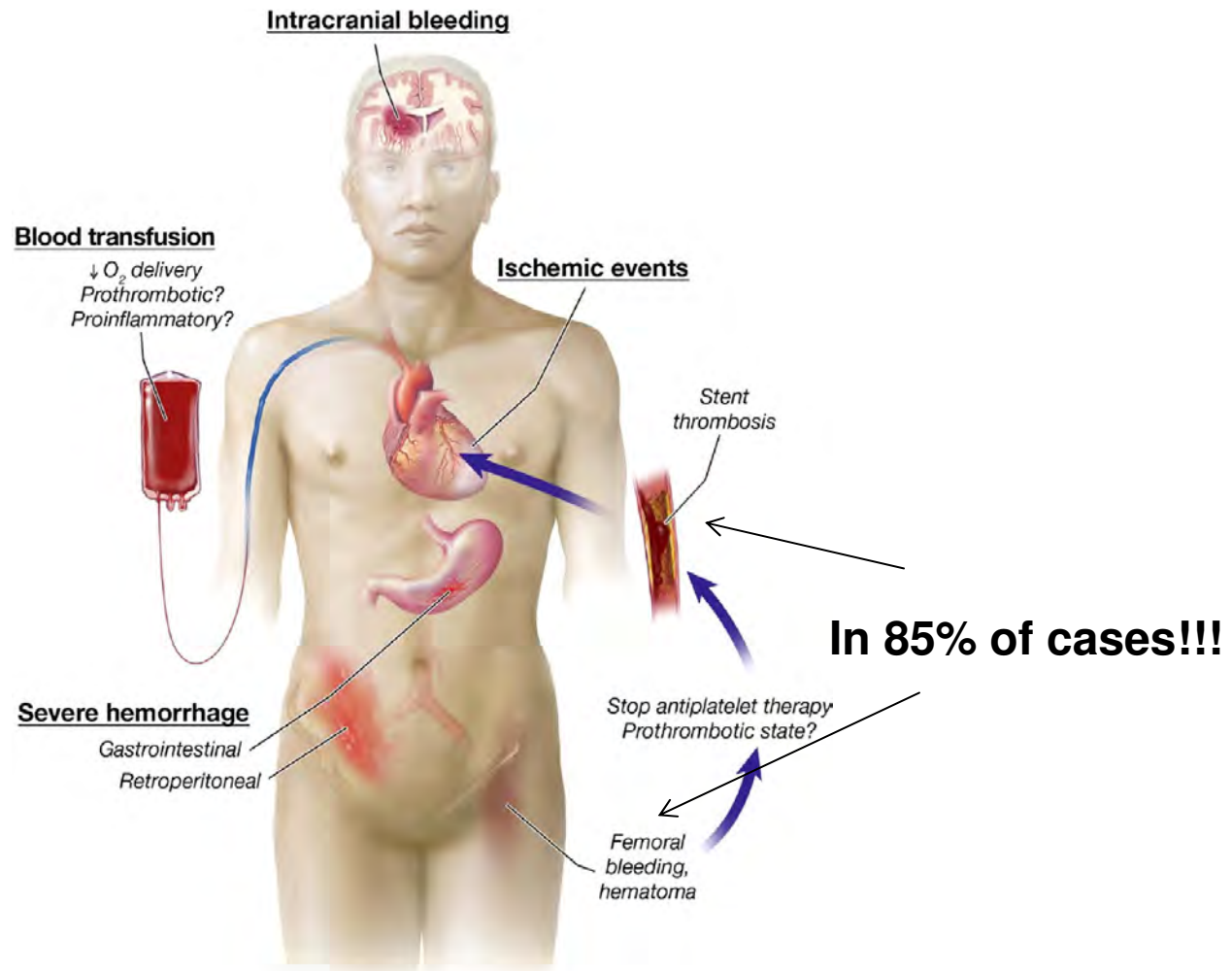
Studies of the Impact of Blood Transfusion on Mortality After PCI

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] 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] 1-year adjusted OR: 3.58 [2.94–4.36]	<0.0001

Doyle, B. J. et al. J Am Coll Cardiol 2009;53:2019-2027

* A subgroup (n = 567) of the overall cohort (n = 6,799) that had "severe" bleeding was studied in this analysis.

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



Doyle, B. J. et al. J Am Coll Cardiol 2009;53:2019-2027

PCI, Bleeding and Mortality

“Bleeding Induces Mortality”

Access Bleeding Complications*: Coronary stenting in 518 patients 10/99-3/01

	Radial		Femoral			
	n	%	n	%		
Gp I: Plavix Pre-PCI	55	0	45	2	4.4%	
Gp II: Abciximab	78	0	68	6	9%	p<.01
Gp III: Pavix Post-PCI	118	0	154	3	2%	
	251	0	267	11	4.1%	p<.01

* DEFINED AS ANY BLEEDING THAT PROLONGS HOSPITALIZATION

נוכח העבודות ההולכות ומתרבות
המדווחות על עליה בתמותה הקשורה
לדימום בזמן PCI ובעיקר בזמן PPCI,
בשלבם האקוטים ואף בתקופה ארוכה
לאחר הפעולה, יש לנקוט בשיטה שתקטין
את הדימום למינימום.

הגישה דרך העורק הרדיאלי כרוכה במעט
מאד דימומים ולכן יכולה לשפר באופן
משמעותי את תוצאות ה PCI המידיות
וארוכות הטווח.

טענות מגני הגישה הפמורלית

- בגישה הרדיאלית יש חשיפה ממושכת יותר לקרינה
- בגישה הרדיאלית החולה מקבל יותר חומר ניגוד
- בגישה הרדיאלית שכיחות CVA גבוהה יותר
- בטיפול ב STEMI בו פתיחת עורק מהירה היא קריטית (TIME IS MUSCLE), הזמן לשם כך ארוך יותר בגישה הרדיאלית מאשר בגישה הפמורלית והחולה עלול להינזק

Time to reperfusion, Fluoroscopy time, Contrast volume

	World data PPCI/TFA	Our experience in PPCI/TRA
Symptom onset to Balloon	Median 218 min	76-918 (median 210) min
Hospital door to Balloon	83-120 (median 116) min	30-180 (median 70) min
Cath Lab door to Balloon	20-53 min	16-40 (median 30) min
Fluoroscopy Time	10-16 min	9.4±5 min
Contrast media volume	127-182 ml	175± 75 ml

Mean procedure durations between groups

Duration (min)	Femoral	Radial	p
Door to intervention	43.53	42.58	NS
Door to sheath	15.97	17.32	NS
Fluoroscopy	15.25	16.7	NS

Chen A. Society for Cardiovascular Angiography and Interventions
2009 Scientific Sessions; May 6-9, 2009; Las Vegas, NV.

TALENT: Right and left access differences

Procedure	Right	Left	p
Diagnostic			
• Fluoroscopy time (sec)	168	149	0.0025
• Dose area product (Gy/cm ²)	12.1	10.7	0.004
Interventional			
• Fluoroscopy time (sec)	696	614	0.087
• Dose area product (Gy/cm ²)	63.1	53.7	0.17

Sciahbasi A. EuroPCR 2010; May 25-28, 2010; Paris, France.

PRESTO-ACS

1170 patients with high-risk non-ST-segment elevation ACS who underwent invasive coronary procedures. Half of all patients undergoing radial-access PCI were treated with glycoprotein IIb/IIIa inhibitors, whereas 34% received the drugs in the femoral-access arm.

PRESTO-ACS: Death/MI and bleeding based on vascular access

End point	Transradial PCI, n=307 (%)	Femoral access PCI, n=863 (%)	p
Death/MI, in hospital	2.6	2.9	0.79
Death/MI at 1 y	4.9	8.3	0.05
Bleeding, in hospital	0.7	2.4	0.05
Bleeding at 1 y	0.7	2.7	0.03

Am J Cardiol 2009; 103: 796-800.

PREVAIL

In the PREVAIL study, the researchers enrolled 1052 consecutive patients undergoing any PCI procedure requiring arterial access. The radial approach was associated with a 63% lower risk of in-hospital major and minor hemorrhages, periprocedural stroke, and entry-site complications. Regarding the secondary end point, a composite of in-hospital death and MI, the radial approach was associated with an 86% lower risk compared with femoral access.

Heart 2009; 95: 476-482.

Why I Prefer the Radial Approach

- In several cases this is the indicated arterial access.
- Very low rate of complications.
- Early patient ambulation, early discharge.
- Patients comfort increases so they love it.
- Medical and nursing staff love it.
- It improves operator skills and when you controls the technique you may loves it.

Why I Prefer the Radial Approach

In several cases this is the indicated arterial access

- Patient at risk for bleeding (GP IIb/IIIa RA, post thrombolysis, pts on coumadin).
- Especially rescue PCI.
- Obese, elderly, restless, pts with PVD.
- Patients with atherosclerotic aorta, iliac and femoral arteries.

Why I Prefer the Radial Approach

Very low rate of complications

- Very low rate of vascular complications
- Very low rate of puncture site bleeding
- Increasing evidences supporting the thesis that TRA for PCI and mainly PPCI reduces immediate and long term mortality!

Why I Prefer the Radial Approach

Early patient ambulation, early discharge

- It is great for the patient and....
- Our cardiology ward have only 7 ICCU and 3 intermediate beds. The trans-radial approach allows more post PCI admission to the intermediate unite, sparing ICCU beds, and higher patient turnover so we can meet the high demand to interventions.

Why I Prefer the Radial Approach

Patients comfort increases so they love it

- Patients that underwent both TFA and TRA cath praise TRA highly.
- Patients know about our approach and ask eagerly for TRA.
- Patients are not confined to bed for hours, they can get off bed and be mobile and independent soon after cath.
- No more prolonged painful and inconvenient pressure of the groin!

Why I Prefer the Radial Approach

Medical and nursing staff love it

- Radial sheath is pulled-out at the cath lab immediately at the end of the procedure.
- No need for prolong high pressure arterial line and close monitoring for bleeding.
- The fellow doesn't have to pull the arterial sheath and to apply prolong and cumbersome pressure prone to vascular complications.

Why I Prefer the Radial Approach

It improves operator skills

- TRA is more challenging but the more you do it you get new and better skills.
- All the procedures done using TFA can be done successfully using TRA (learning curve is mandatory).
- From personal experience an operator with large TRA practice has a better filling for interventional cardiology as a whole.
- TRA is elegant, neat and precise method good for all-patients, physicians and nurses.

שבילי עיזים יובילוך לגבהים
מופלאים שם אין אוטוסטרדות

מרומי סיני



מרומי ההימלאיה

ועוד היד נטויה



תודה על הקשבתכם