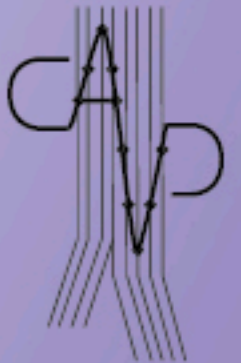


The background of the slide features a stylized, blue-tinted image of the Eiffel Tower, showing its intricate lattice structure. The tower is positioned on the left side and extends diagonally across the frame.

CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE  
CONTROVERSIES & UPDATES  
IN VASCULAR SURGERY

**FEBRUARY 7-9 2019**

MARRIOTT RIVE GAUCHE & CONFERENCE CENTER  
PARIS, FRANCE [WWW.CACVS.ORG](http://WWW.CACVS.ORG)



*Treatment of access-related ischemia*

**PAI**

**Proximalization of the arterial inflow**

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**Department of General, Visceral and Vascular Surgery**



### Disclosure

Speaker name: Jürgen Zanow

- .....
- I have the following potential conflicts of interest to report:
  - Consulting
  - Employment in industry
  - Shareholder in a healthcare company
  - Owner of a healthcare company
  - Other(s)
  - I do not have any potential conflict of interest

## Treatment of ARI

❖ **Resolving ARI**

❖ **Maintenance of vascular access**



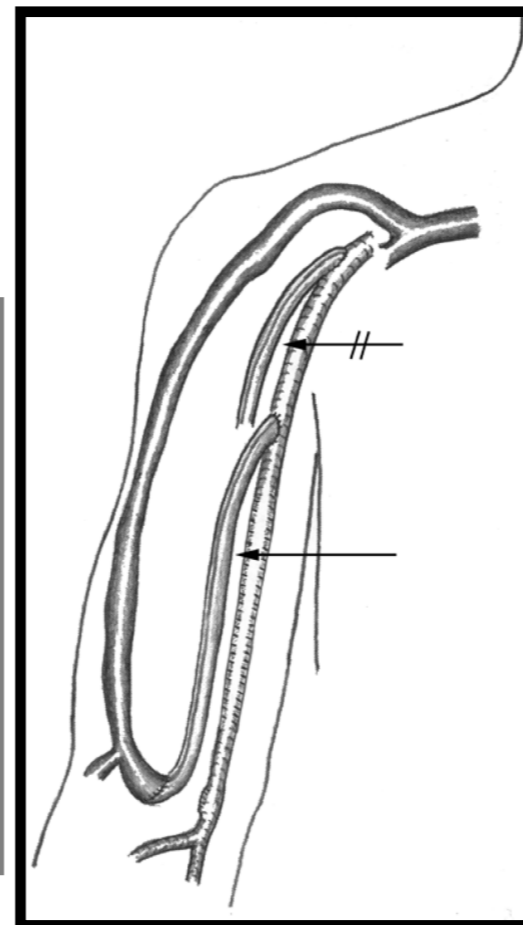
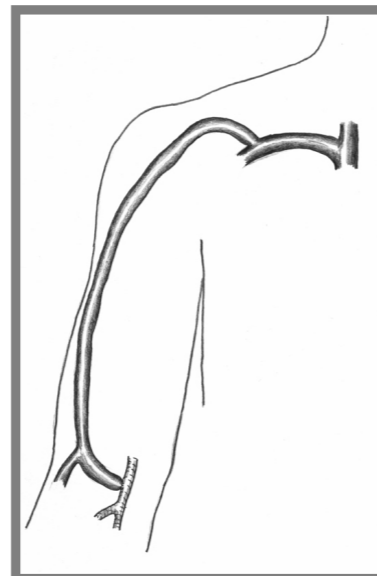
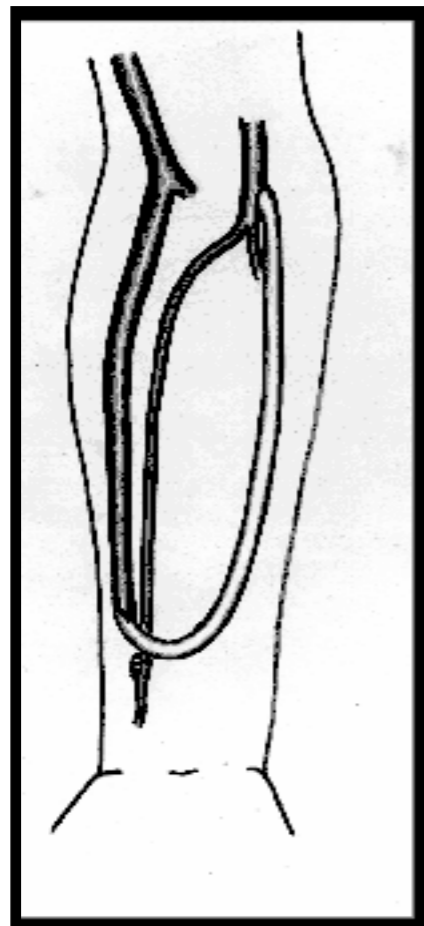
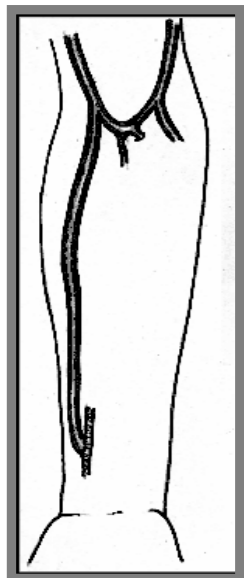
⇒ **Increase of distal arterial perfusion pressure**

⇒ **Sufficient access flow (for HD and patency)**



# Proximalization of the arterial inflow (PAI)

- Closure of distal **AV** anastomosis,
- Interposition of ePTFE graft or vein segment between matured fistula vein and artery at more proximal level.



***Avoid high-flow PAI***

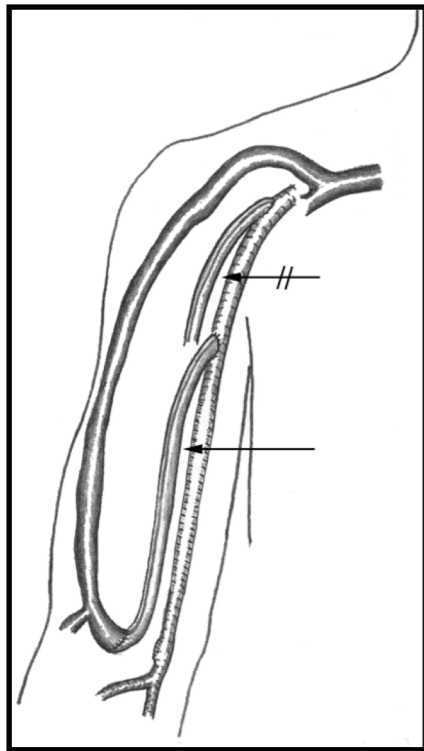
***5 mm ePTFE graft***

***4-7 mm ePTFE graft***

***GSV, basilic vein***



## PAI - How does it works?



More central artery

— Larger diameter

— Higher capacity of flow

↓  
Lower pressure drop at AV anastomosis

↓  
Increase of distal perfusion pressure and flow

- Small AV anastomosis
- Use of narrow diameter / tapered grafts
- No side-to-side anastomosis with vein

**Limitation of flow** ←



**Low infection risk** ←



- Usually no graft puncture  
*Graft works only as feeding vessel*



## Indication for PAI

- **ARI**

(normal or low access flow)

*AVF < 800 ml/min*

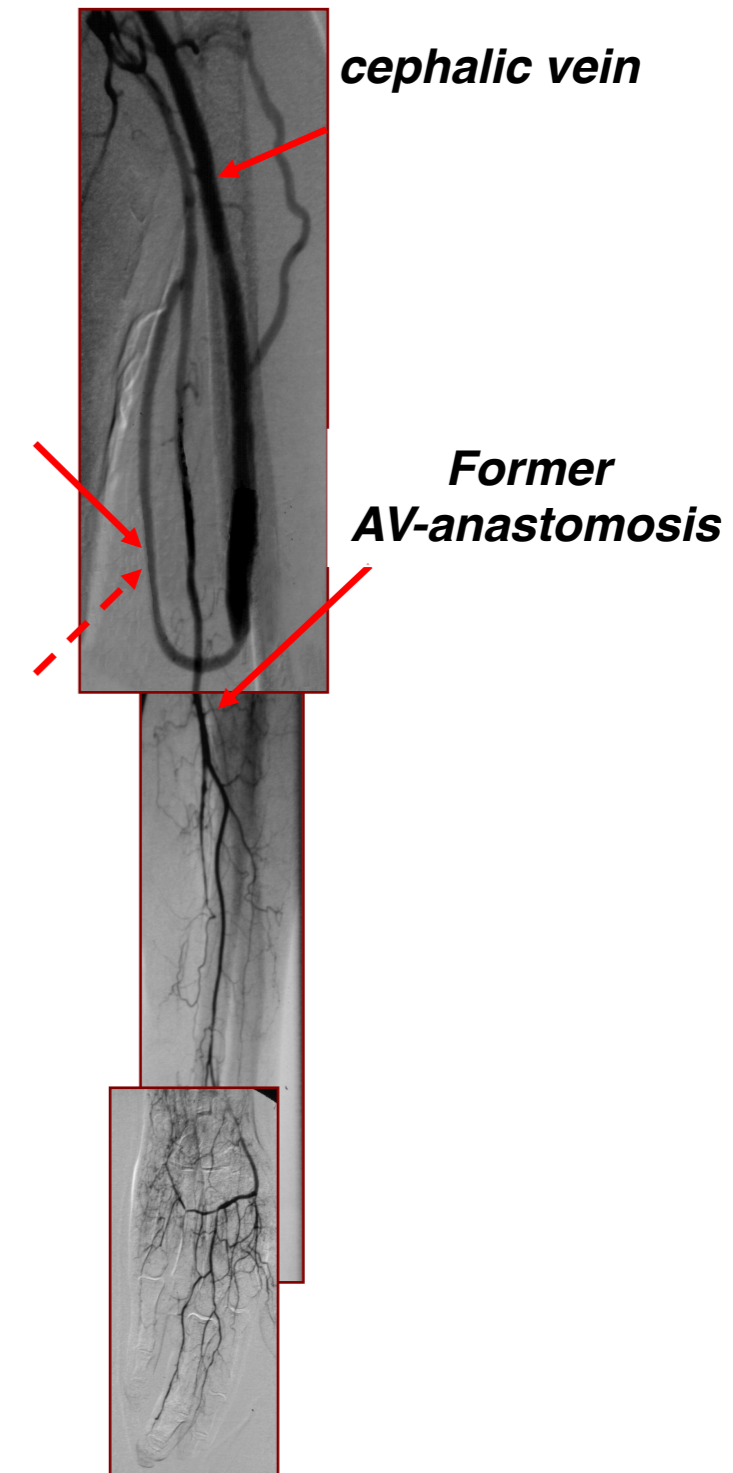
*AVG < 1400 ml/min*

*5 mm ePTFE graft*

*4-7 mm ePTFE graft*

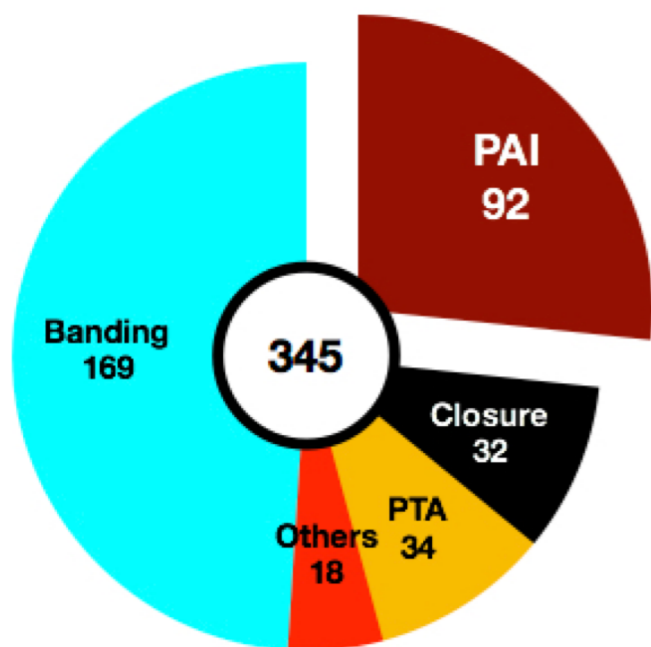
*GSV, basilic vein*

- *Failed maturation of good fistula vein because of low arterial inflow*





1996-2016



DBI

Flow volume

Results PAI

- 4-7 mm ePTFE graft
- 4 or 5 mm ePTFE graft
- cephalic vein (valvulotomied rev)

radio-cephalic AVF	4
ulno-basilic AVF	2
brachio-cephalic AVF	31
brachio-cephalic-basilic AVF	16
brachio-basilic AVF	15
loop forearm AVG	3
straight upperarm AVG	19
loop upperarm AVG	2

N=

N=

N=

I=

I=

Ve

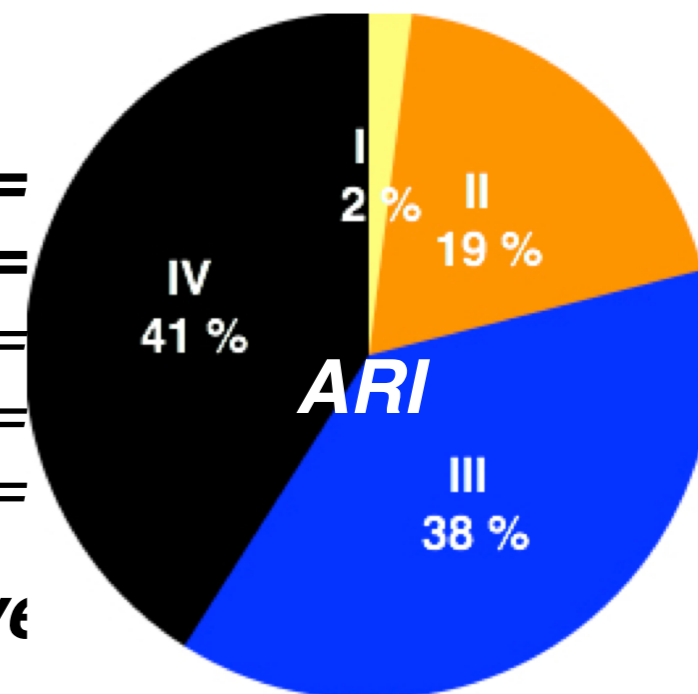
Ve

Ve

Ve

l/min

l/min



Patency (1°/2°) @ 12 months: 91% / 93% @ 36 months: 72% / 81%

ARI symptom resolution

Improvement

Complete

@ 1 month

100%

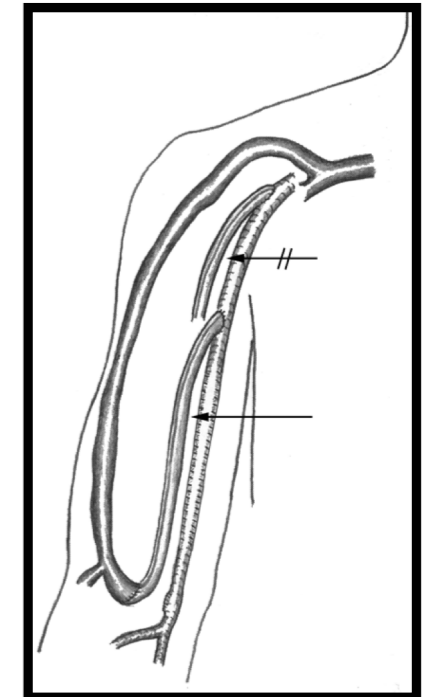
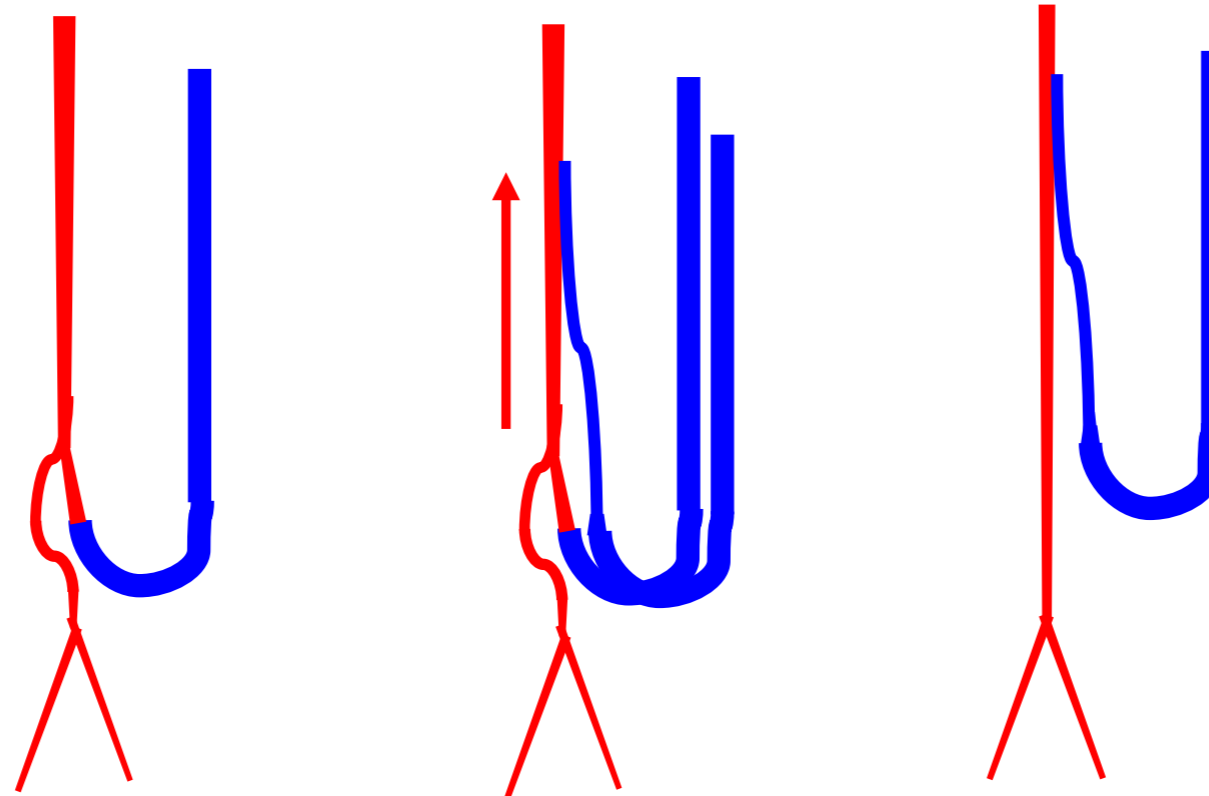
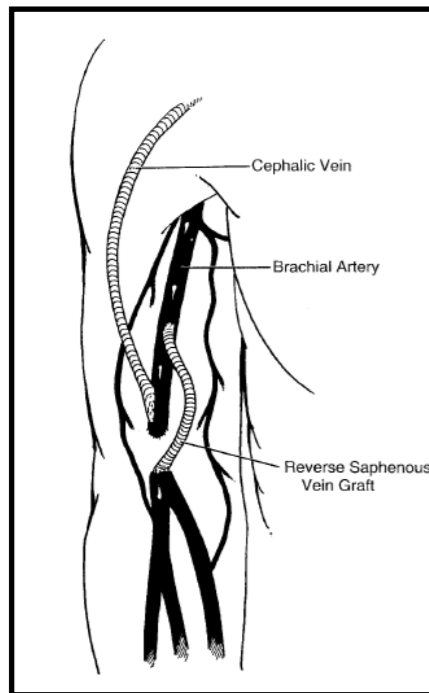
84%

@ 12 months

100%

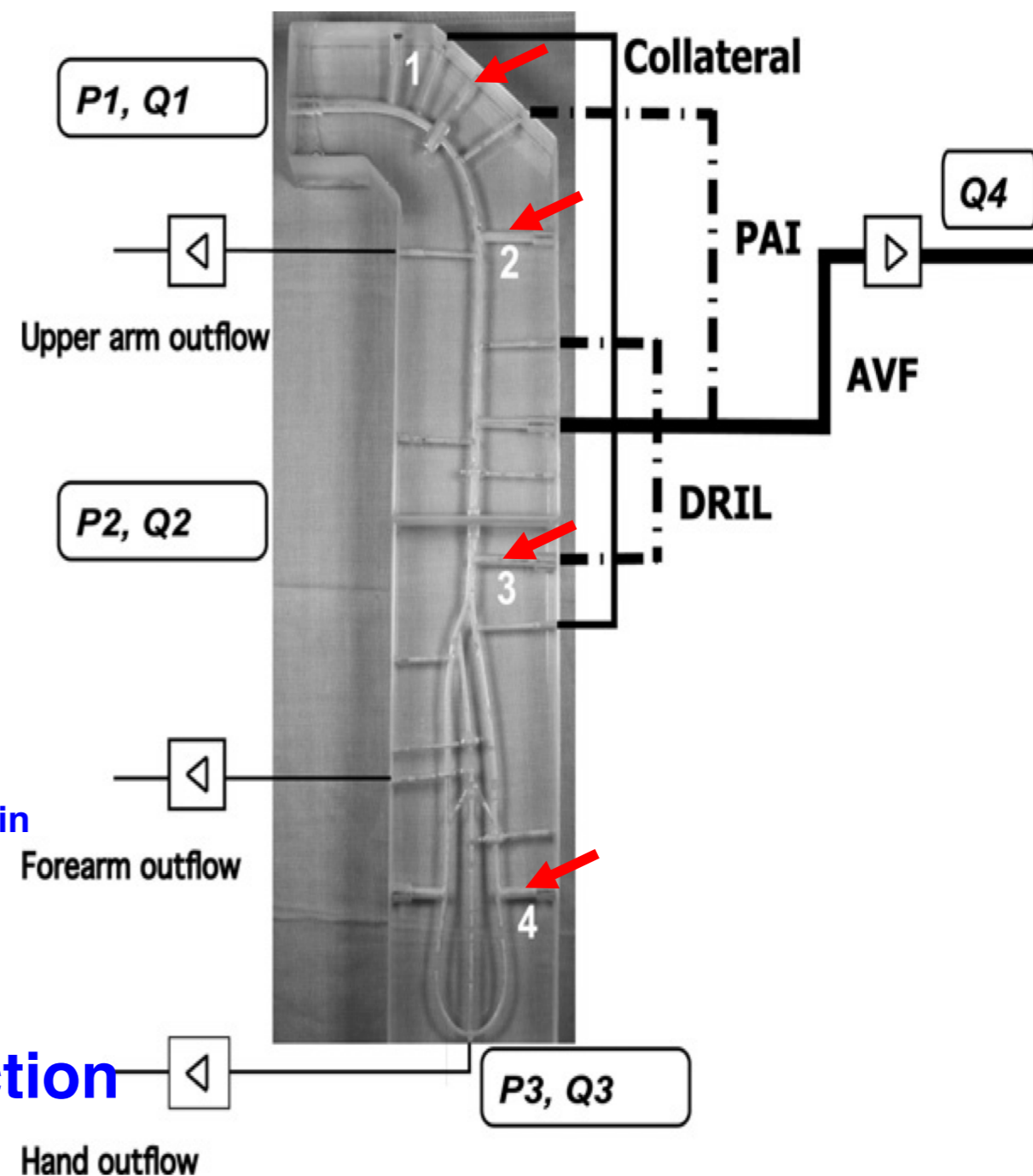
89%

## DRIL vs. PAI



- **No ligation of patent artery – no potential harm of distal perfusion,**
- **Improved flow in low-flow AV accesses,**
- **Similar results for ARI,**
- **Easy to perform,**
- **No vein needed as arterial bypass (Never use PTFE for DRIL!).**





## Simulation of

### - AVF caused distal ischemia

Normal:  $Q4=0$ ,  $P1=100$  mmHg:  $P3=93$  mmHg,  $Q3=30$  ml/min

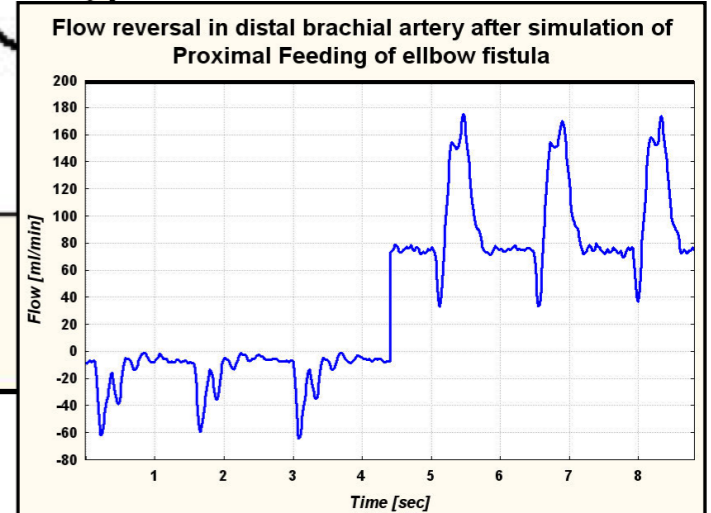
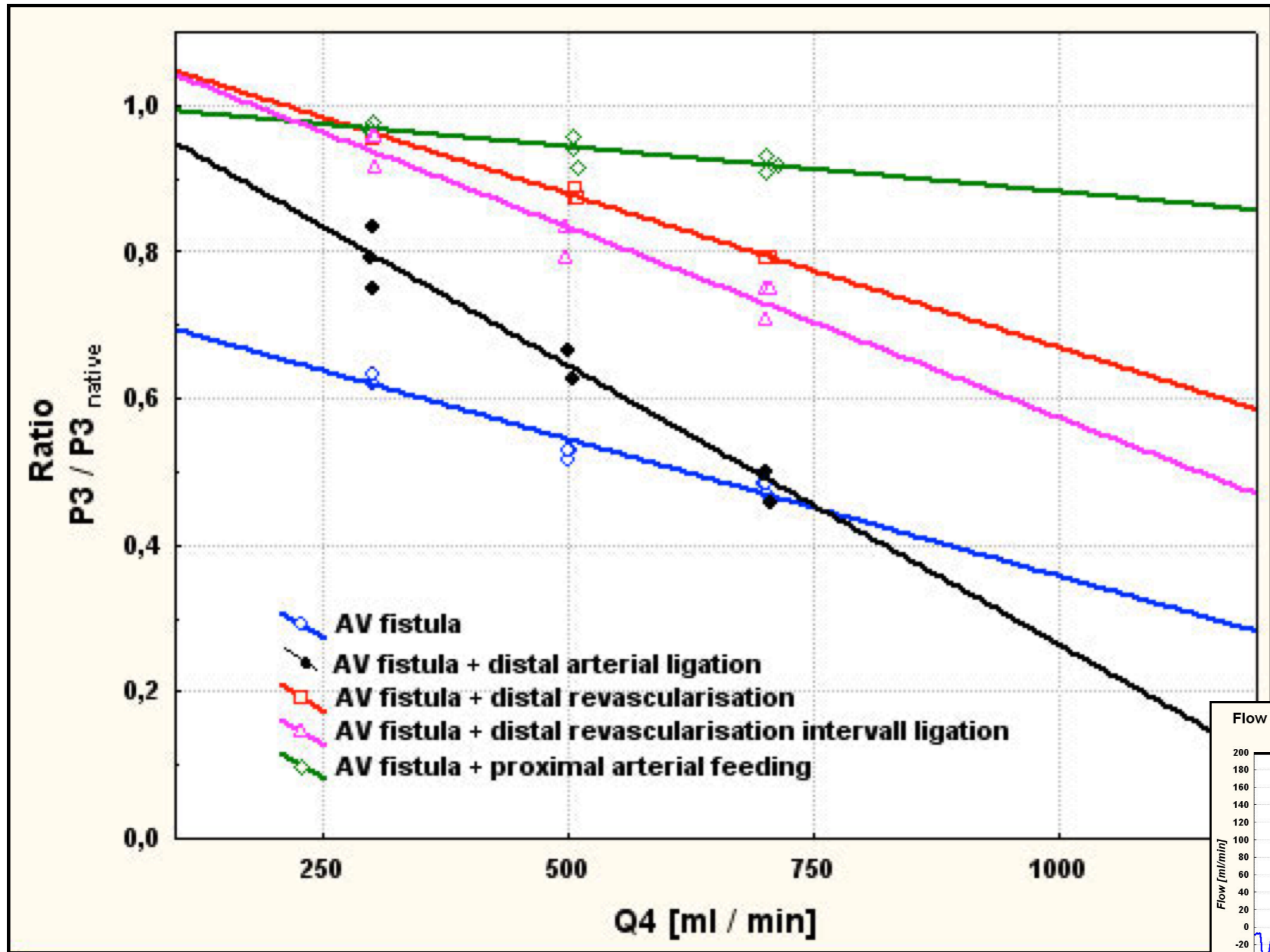
Ischemia:  $P3 < 40$  mmHg,  $Q3 < 15$  ml/min

### - collateralization

### - different procedures of reconstruction

Adjustment of  $P1=100$  mmHg and  $Q4$

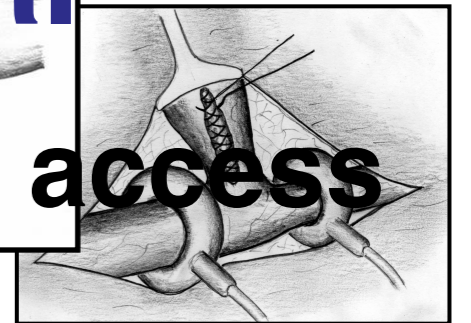
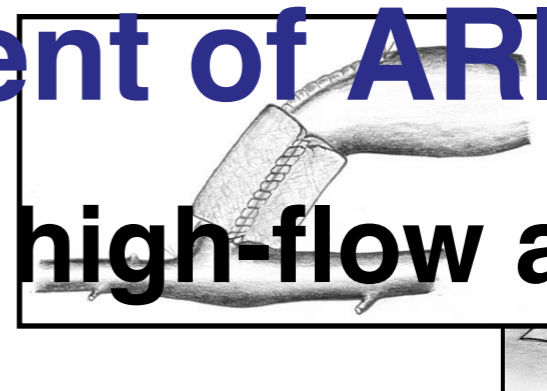
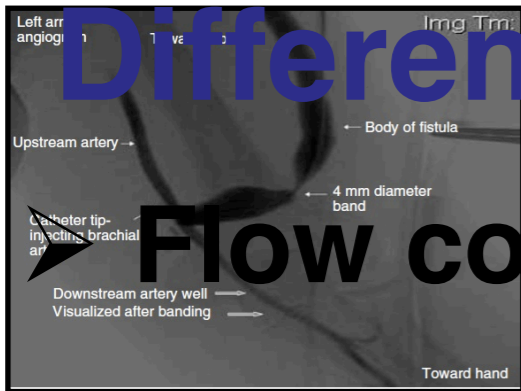
Simultaneous measurement of  $P1-P3$  and  $Q1-Q4$





# Differentiated management of ARI

## Flow controlled banding for high-flow access



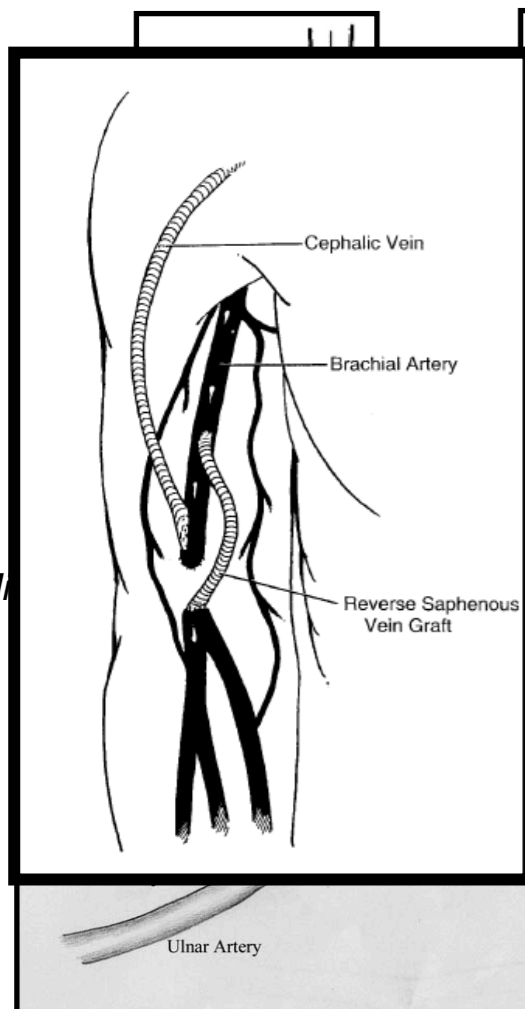
## PAI for normal- and low-flow access

**MILLER**  
Miller et al. *Kidney Int* 2009

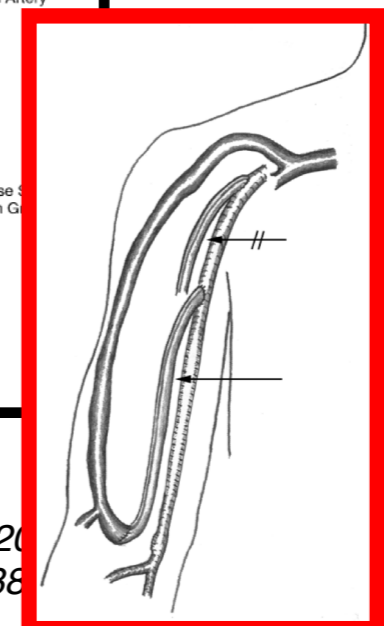
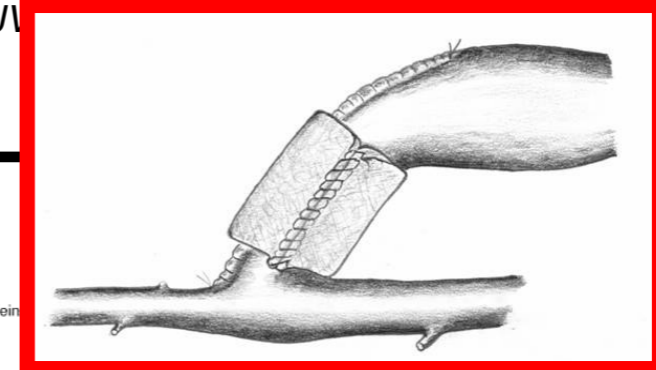
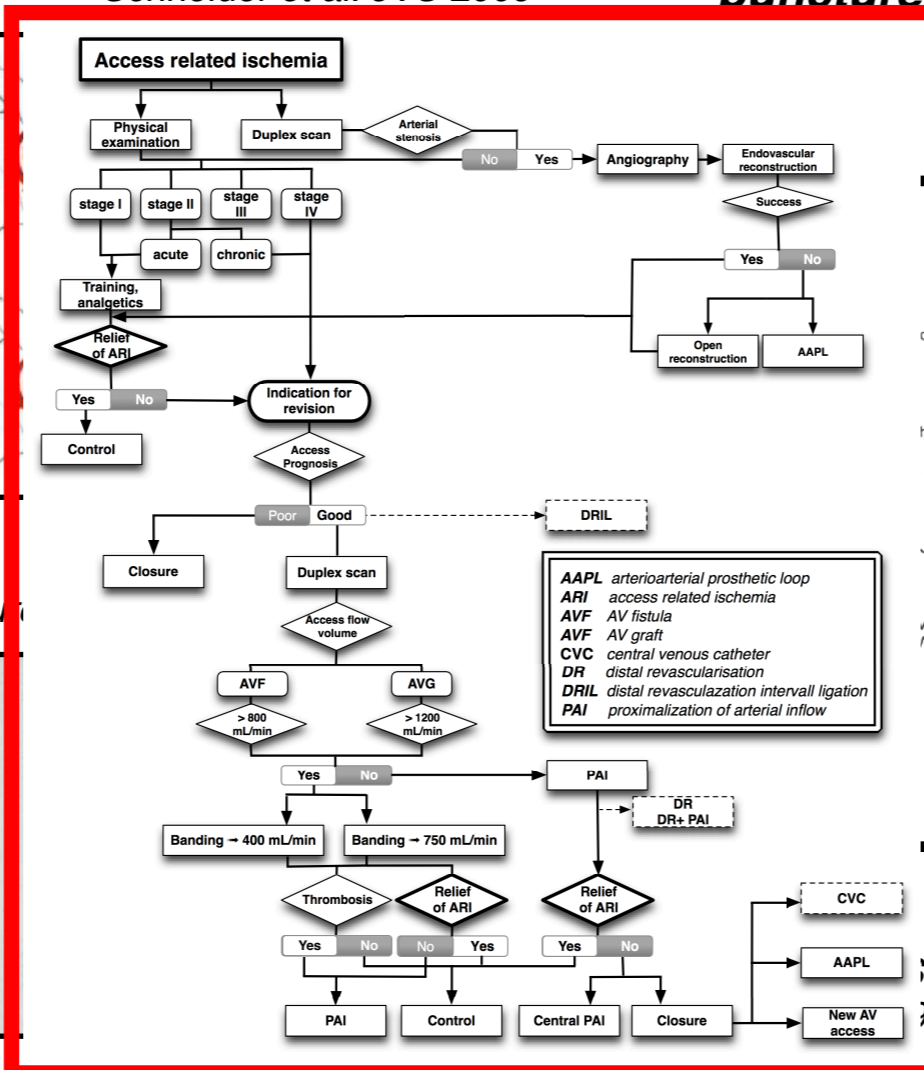
**Banding**  
Schneider et al. *JVS* 2009

**Banding between puncture sites**

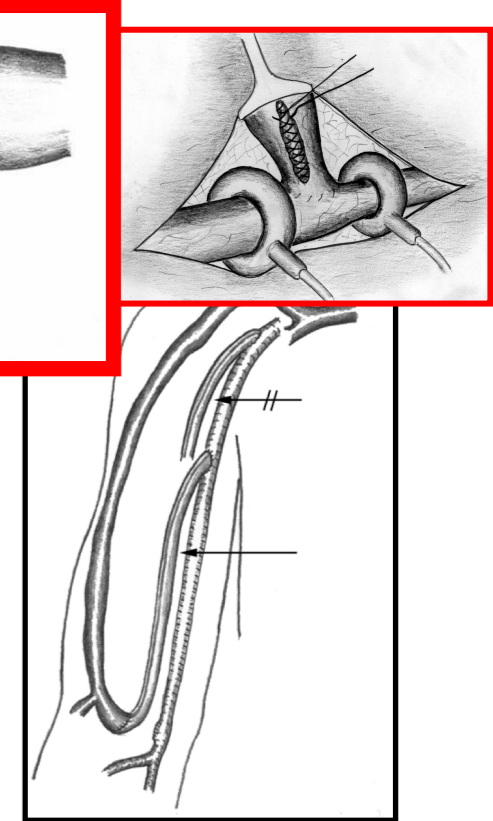
**Flow controlled banding**  
Zanow et al. *JVS* 2006



**Extension Technique**  
Ehsan et al. *EJVS* 2005



**PAI**  
Zanow et al. *JVS* 2006





## Conclusions

**PAI is an effective and durable alternative to DRIL  
(without ligation of a patent artery),  
especially for low and normal flow AV access,  
with similar results regarding ischemia  
and patency of AV access.**