## Below the Knee Interventions and Angiosome Concept



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Critical Limb Ischemia Treatment Goals

- Improve healing
- Limb salvage
- Improve functional capacity
- Improve quality of life
- Prolong life

# Critical Limb Ischemia Revascularization

### Revascularization is better Amputation 8-20% vs >50% if no revasc Revasc Strategy evolution

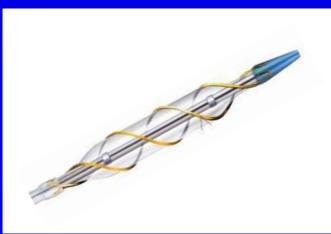
- Single line to the foot
- Two main vessel to foot
- As many vessels as possible
- Open inflow as source of collaterals
- Angiosome oriented revascularization

### **Balloon Devices**

### POBA



### Angiosculpt



#### **Cutting Balloon**



### **PolarCath Balloon**



## **Atherectomy Devices**

#### **Turbo-Laser**

### Silver Hawk

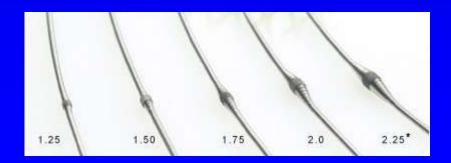


#### **Rotablator**





#### **CSI 360 Orbital Atherectomy**



### **Drug Eluting Devices**

### **Drug Eluting Stents**

### **Drug Eluting Balloon**





## **Critical Limb Ischemia**

**Total lesions Bellow the knee** CTO **Multilevel BK** alone Antegrade **Antegrade-Retrograde Non-CTO success CTO success** 

**907 (3.0 L/patient)** 406 lesion (1.9 L/patient) **57% of procedures 49% of procedures 33% of procedures** 40% 10% 99% 89%

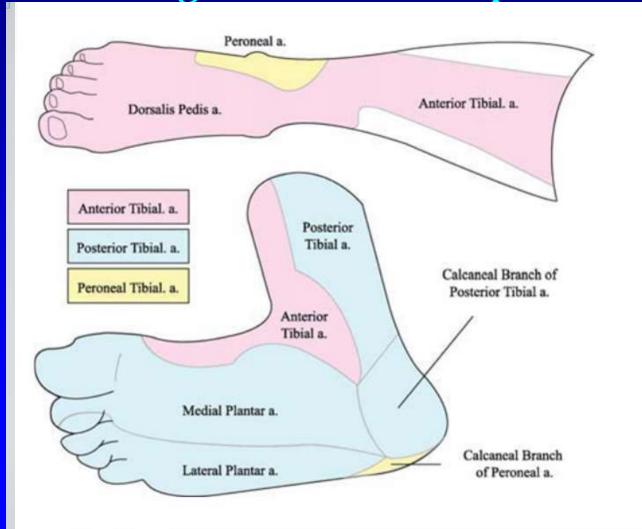




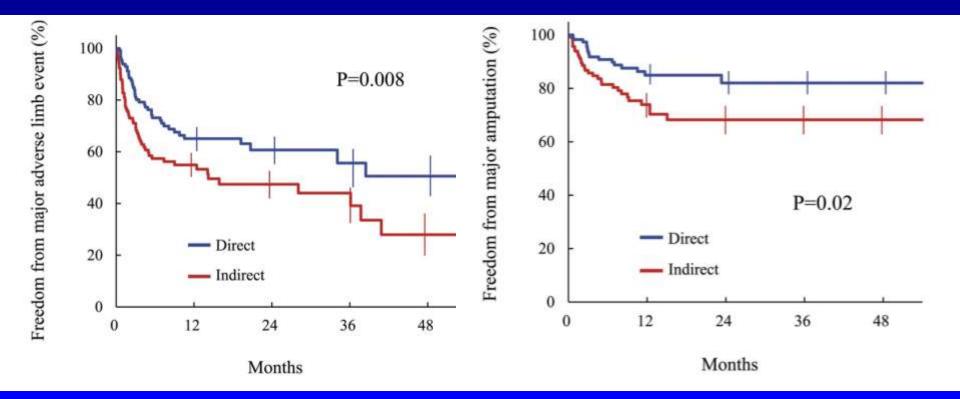
### **Pre and procedural preparation**

- Imaging (CTA, MRA and DA)
- Know the entire anatomy, including foot
- Understanding of entry and exit areas
- Presence of side branches
- Collateral circulation
- Distal target
- Use of road mapping
- Appropriate support
- Appropriate antithrombotic

## Critical Limb Ischemia Angiosoma Concept

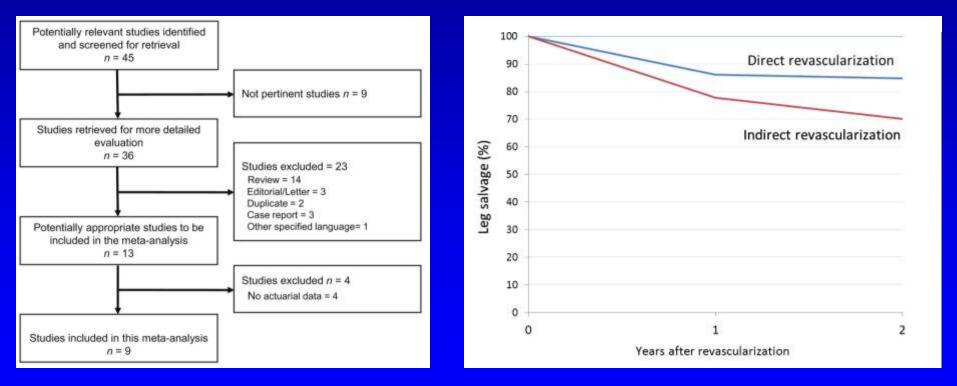


# **Direct vs Indirect Revasc in BK interventions for CLI (360 pts)**



lida O et al. Journal of Vascular Surgery : 2012;563

# **Metaanalysis of reported studies**



Biancari F et al. European Journal of Vascular and Endovascular Surgery May 2014

# **Limb Salvage**

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|                       |       |       |                    |      | Hazard Ratio                          |  |
|-----------------------|-------|-------|--------------------|------|---------------------------------------|--|
| Study or Subgroup     | Total | Total | IV, Random, 95% Cl | Year | IV, Random, 95% Cl                    |  |
| Varela 2010           | 45    | 31    | 0.76 [0.28-2.01]   | 2010 |                                       |  |
| Alexandrescu 2011     | 134   | 98    | 0.52 [0.24-1.14]   | 2011 |                                       |  |
| Blanes Ortí 2011      | 18    | 16    | 0.55 [0.10-3.11]   | 2011 |                                       |  |
| Ferrufino-Mérida 2012 | 23    | 9     | 0.02 [0.00-0.09]   | 2012 |                                       |  |
| lida 2012             | 200   | 169   | 0.70 [0.43-1.14]   | 2012 |                                       |  |
| Kabra 2013            | 39    | 25    | 0.50 [0.13-1.86]   | 2013 |                                       |  |
| Lejay 2013            | 36    | 22    | 0.31 [0.14-0.71]   | 2013 |                                       |  |
| Söderström 2013       | 121   | 129   | 0.62 [0.31-1.25]   | 2013 | -                                     |  |
|                       | 616   | 499   | 0.44 [0.26-0.75]   |      | •                                     |  |
|                       |       |       |                    |      | 0.005 0.1 1 10 200                    |  |
|                       |       |       |                    | Fá   | avours direct revasc. Favours revasc. |  |

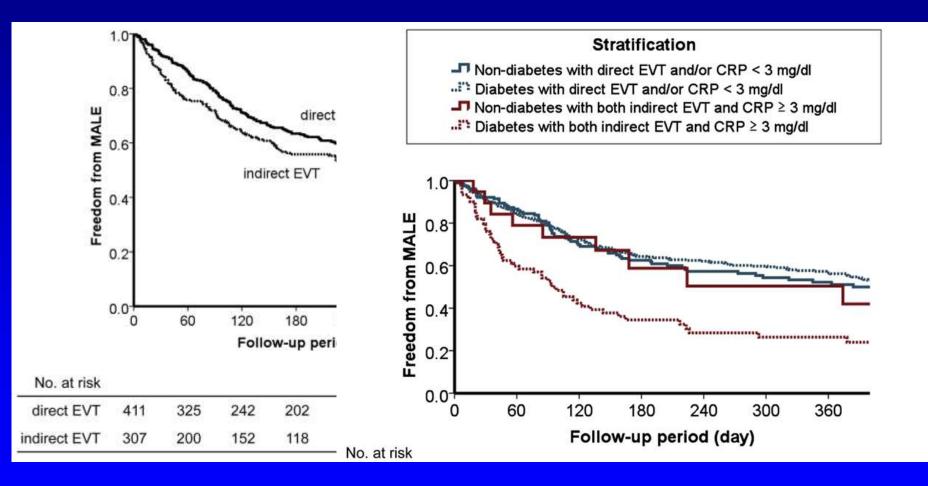
Biancari F et al. European Journal of Vascular and Endovascular Surgery May 2014

## **Wound Healing**

|                   |       | 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - | Hazard Ratio                             |        | Hazard Ratio               |                       |  |
|-------------------|-------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------|--------|----------------------------|-----------------------|--|
| Study or Subgroup | Total | Total                                                                                                           | Total IV, Random, 95% Cl Year IV, Random |        | IV, Random, 9              | 5% CI                 |  |
| Varela 2010       | 45    | 31                                                                                                              | 0.75 [0.44-1.27]                         | 2010   |                            |                       |  |
| Azuma 2012 a      | 59    | 51                                                                                                              | 0.82 [0.55-1.21]                         | 2012   | -                          |                       |  |
| Azuma 2012 b      | 67    | 41                                                                                                              | 0.55 [0.36-0.85]                         | 2012   |                            |                       |  |
| Kabra 2013        | 39    | 25                                                                                                              | 0.55 [0.31-0.97]                         | 2013   |                            |                       |  |
| Söderström 2013   | 121   | 129                                                                                                             | 0.56 [0.39-0.81]                         | 2013   | -                          |                       |  |
|                   | 331   | 277                                                                                                             | 0.64 [0.52-0.78]                         |        | •                          |                       |  |
|                   | 1     |                                                                                                                 |                                          | H<br>( | 0.01 0.1 1                 | 10 100                |  |
|                   |       |                                                                                                                 |                                          |        | Favours direct revasc. Fav | ours indirect revasc. |  |

Biancari F et al. European Journal of Vascular and Endovascular Surgery May 2014

## **Diabetes vs Non-Diabetes Status**

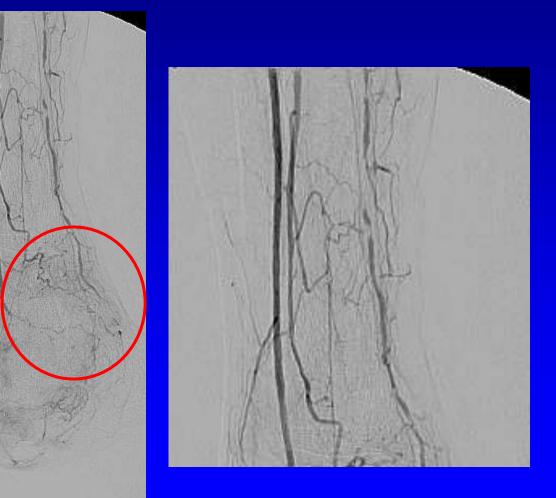


lida O et al. European Journal of Vascular and Endovascular Surgery : 2013;576

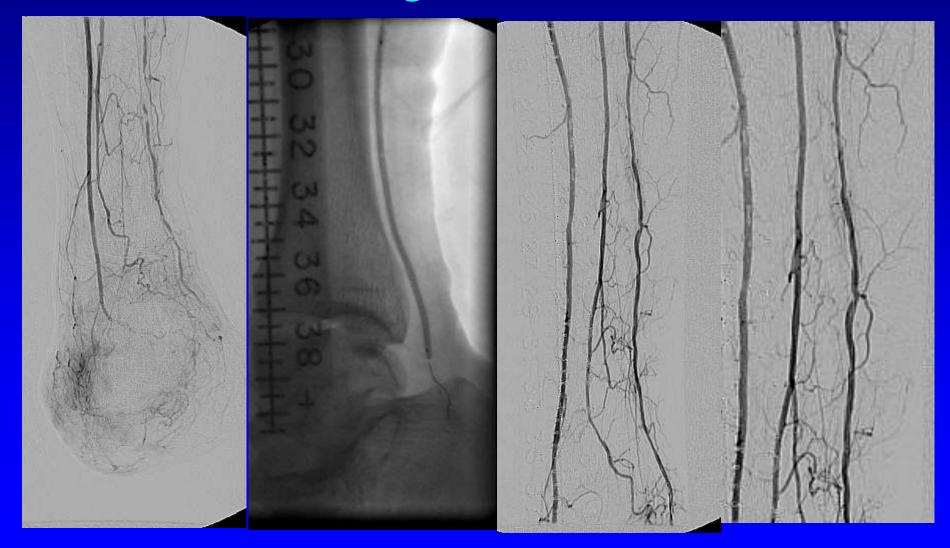
### **Below the knee Interventions**

### Adequate Imaging





# Below the knee Interventions Long Balloons



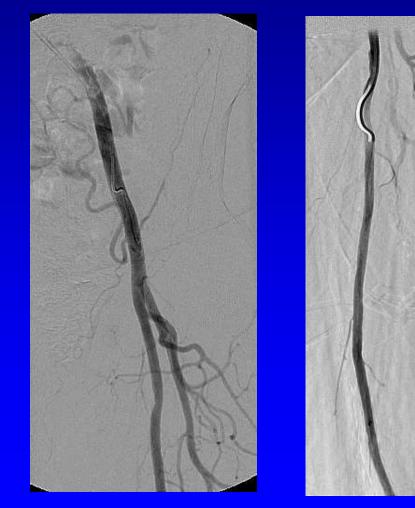
### **BK Interventions in CTO**

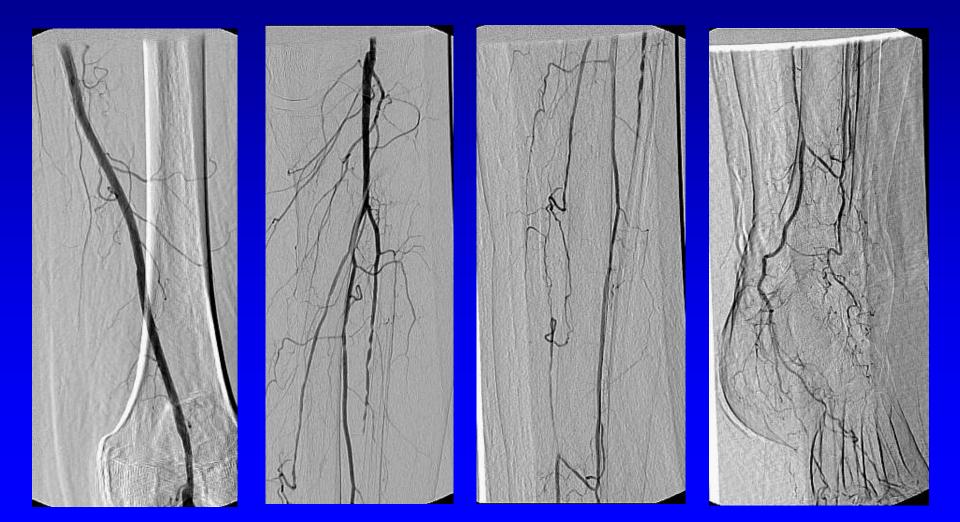
- Arterial Access
- Procedural imaging preparation
- Understand the anatomy
- Intraluminal approach
- Subintimal approach
- Assisted re-entry devices
- Antegrade-Retrograde approach

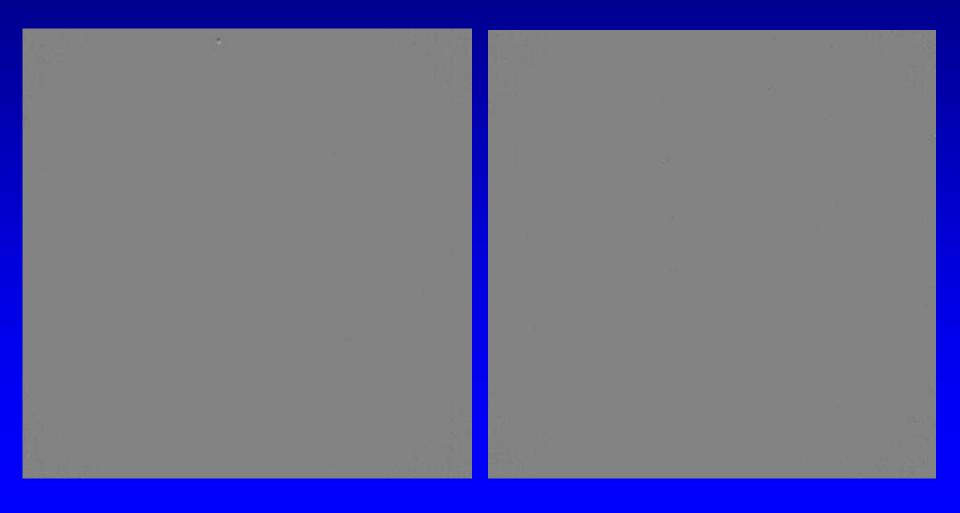
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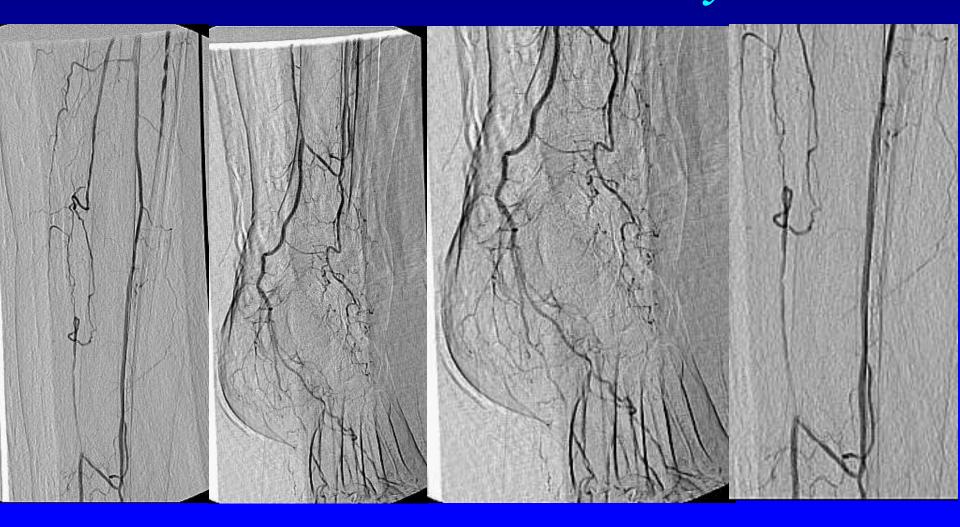
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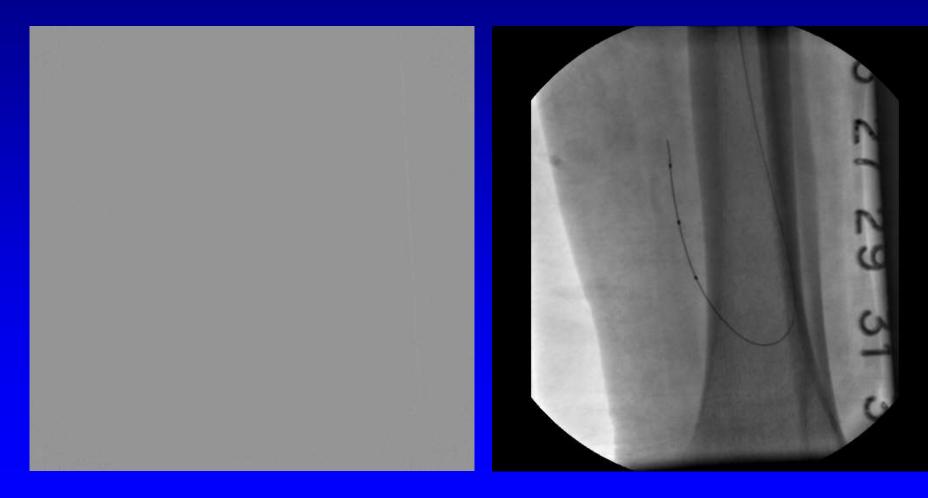


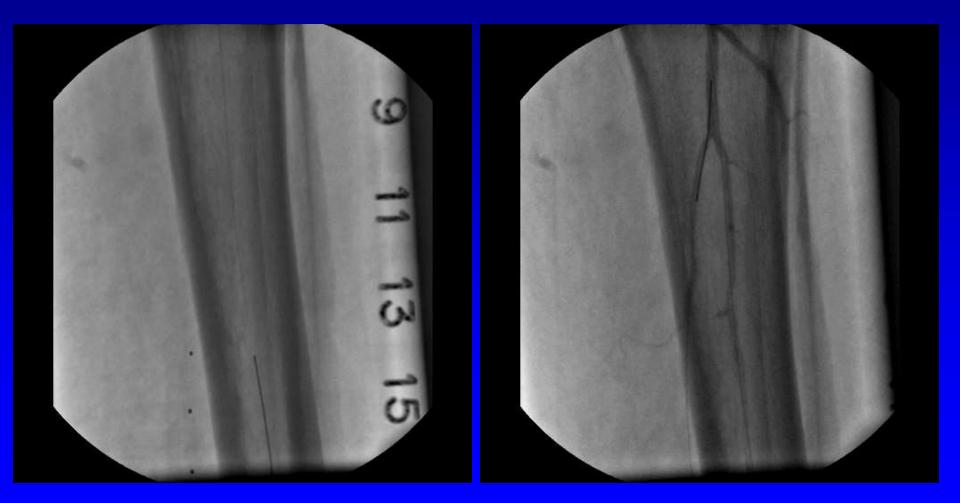


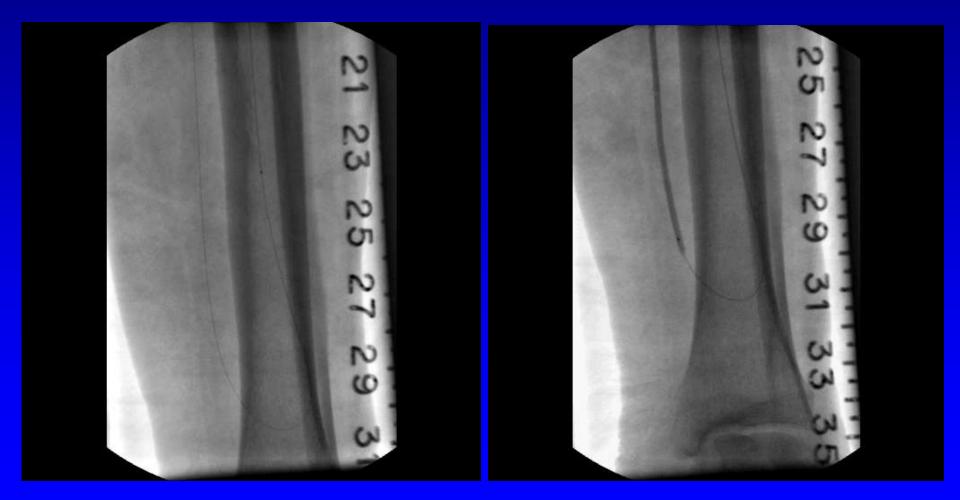


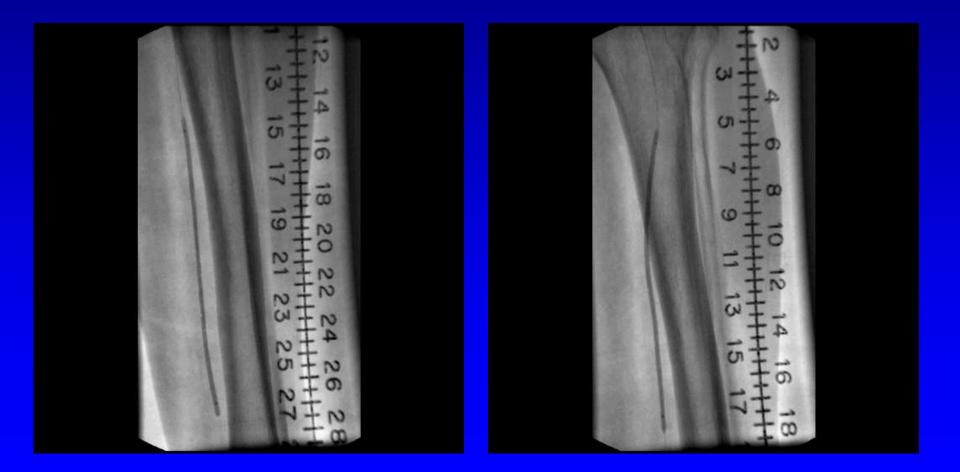


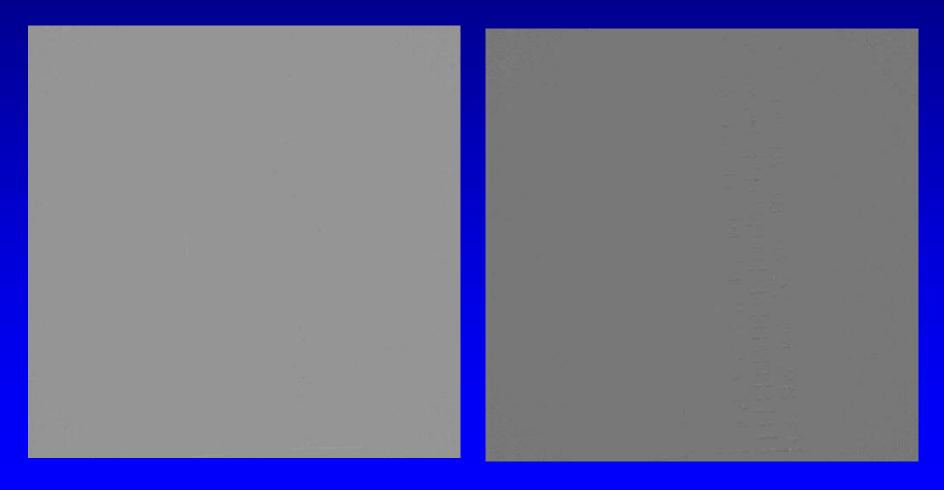










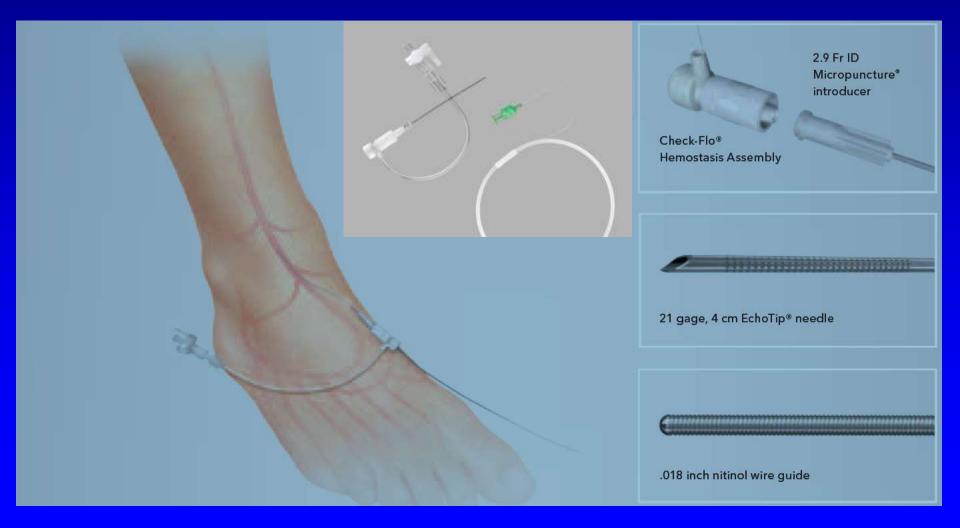




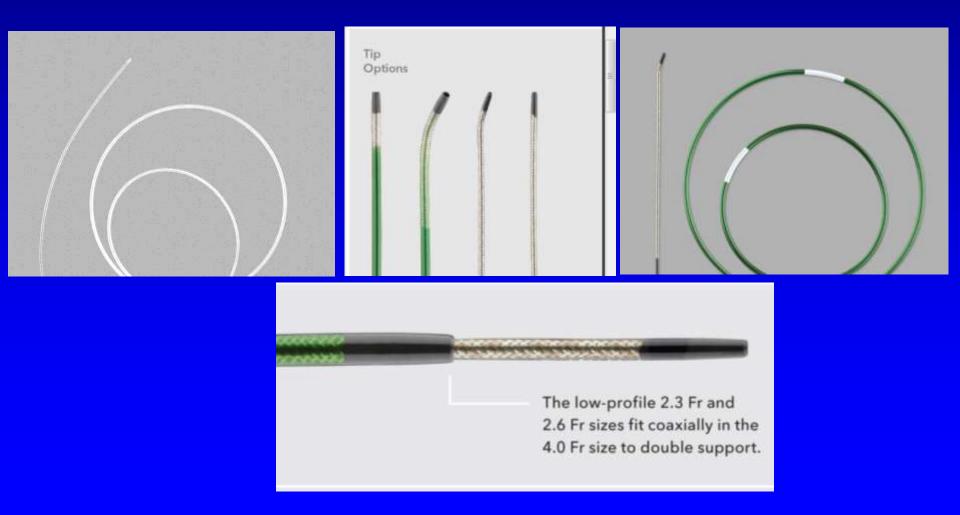
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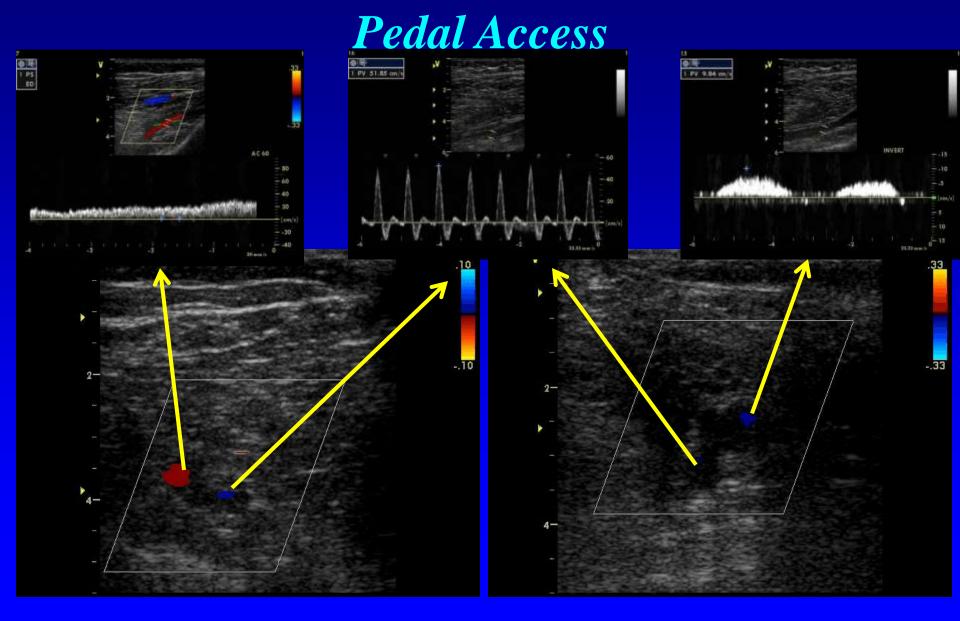
## Below the knee Interventions Pedal Access Tools



# Below the knee Interventions Pedal Access Tools



### **Below the knee Interventions**

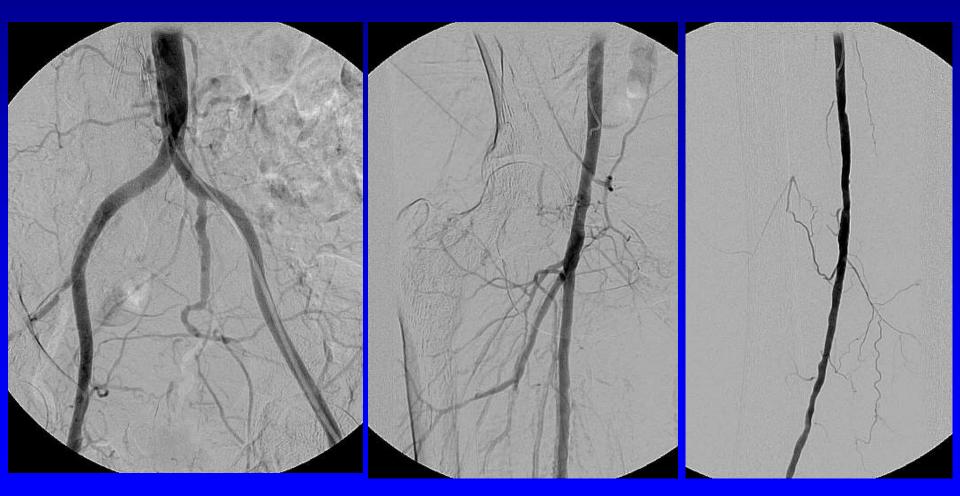


# Below the knee Interventions *Pedal Access*



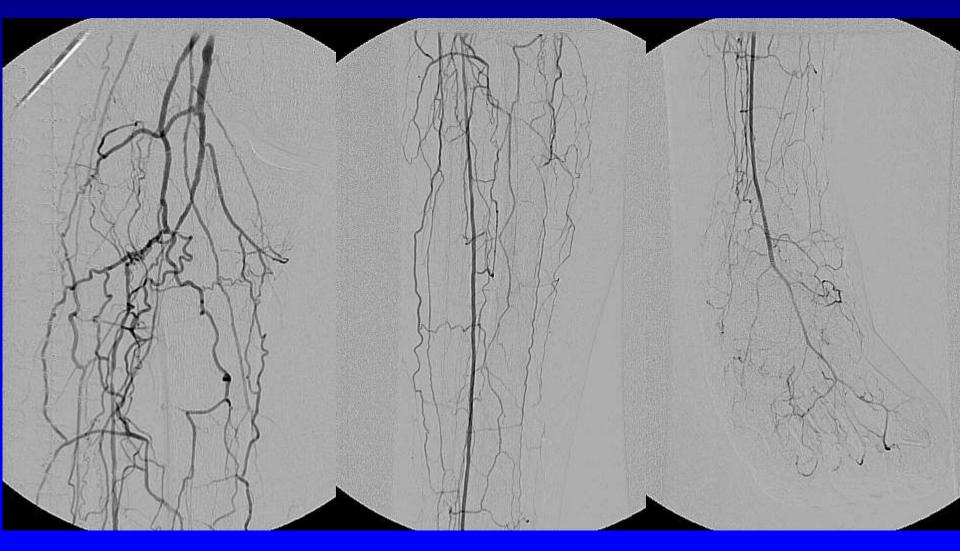
# **Below the knee Interventions**

### **Pedal Access**

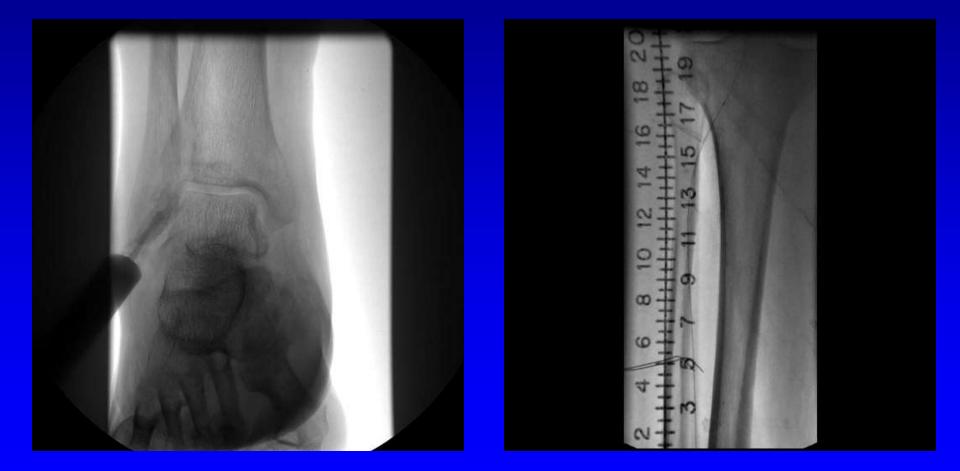


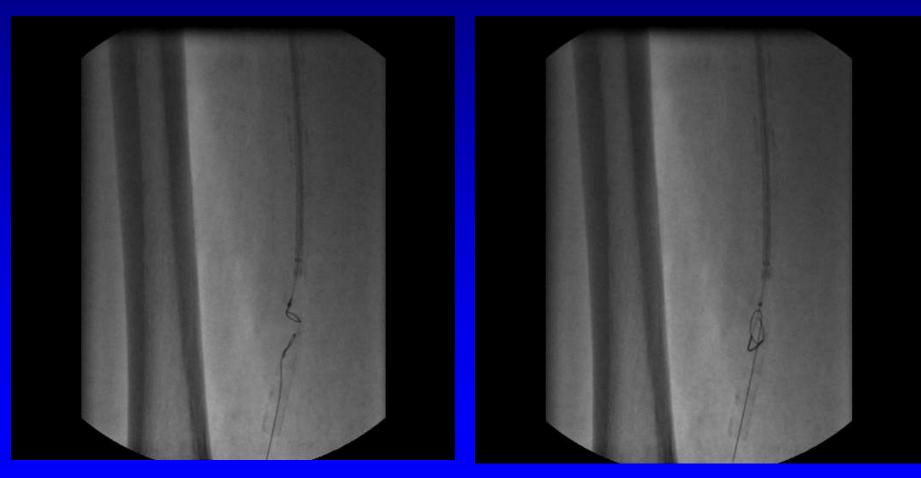
## **Below the knee Interventions**

### Pedal Access

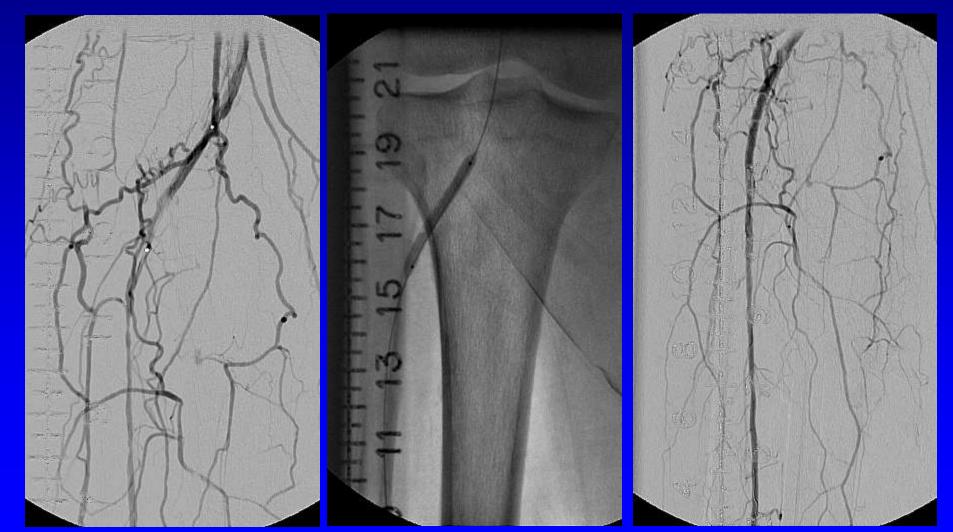


# Below the knee Interventions *Pedal Access*











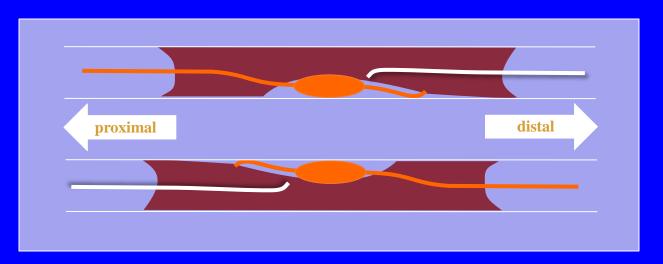




#### **CART or Reverse CART**

Retrograd e wire crossing If 1° failed The antegrade balloon can get into CTO body and the retrograde wire can reach the antegrade balloon advanced in CTO body.





Below the knee Interventions Pedal Access techniques

- CART
- Reverse CART
- Direct intervention from pedal
- Snaring wire and reverse
- Initial pedal PTA and reverse

## **Angiosome Concept**

- No prospective evaluation
- Used of historical controls
- Most studies used different definitions with no anatomical information
- Not information from studies of degree of tissue loss between groups
- Studies performed at different times
- Possible selection bias. Good targets versus diffuse atherosclerosis. More advanced disease versus less disease, etc

## **Angiosome Concept**

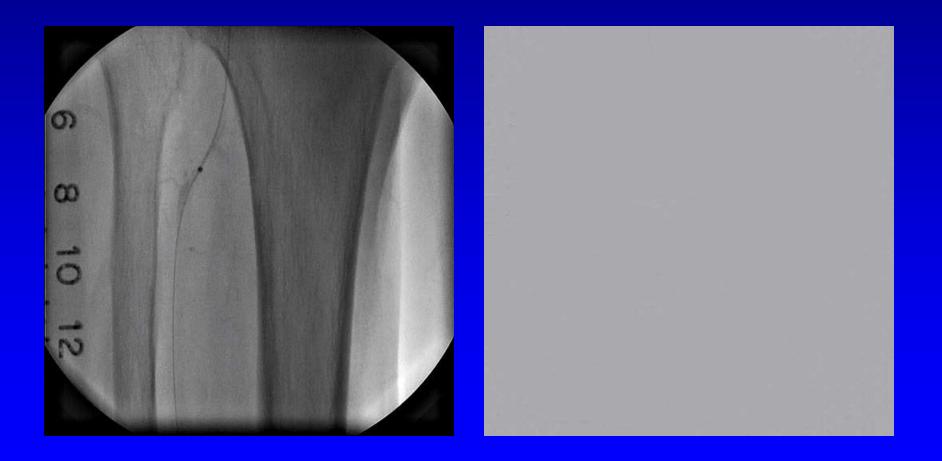
- Not beneficial in non-diabetics (collateral circulation is not as affected)
- The presence of good plantar arch might be the best predictor
- Patients with ischemic limbs have different angiosome distribution
- Interangiosome connection
- Not able to get direct revascularization might be the main predictor

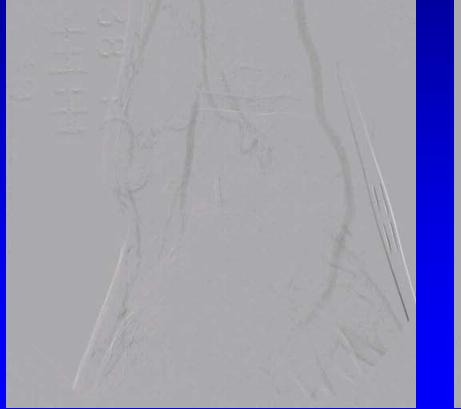
Thank you



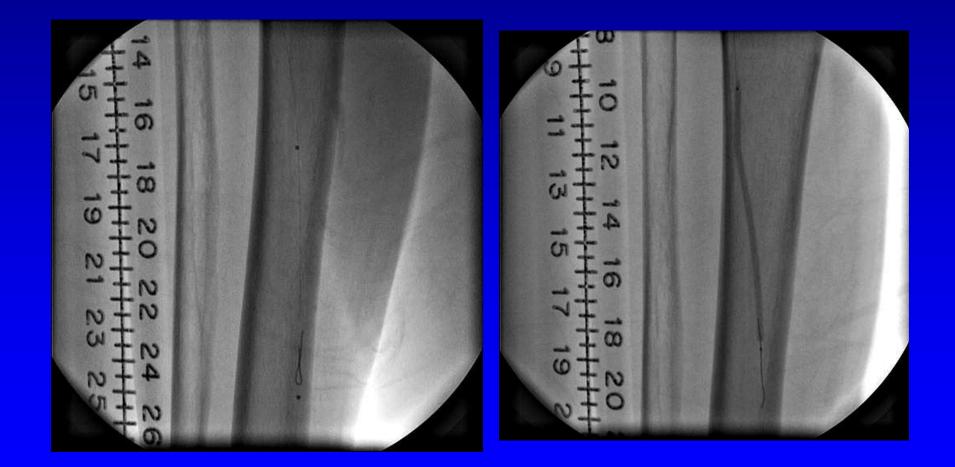


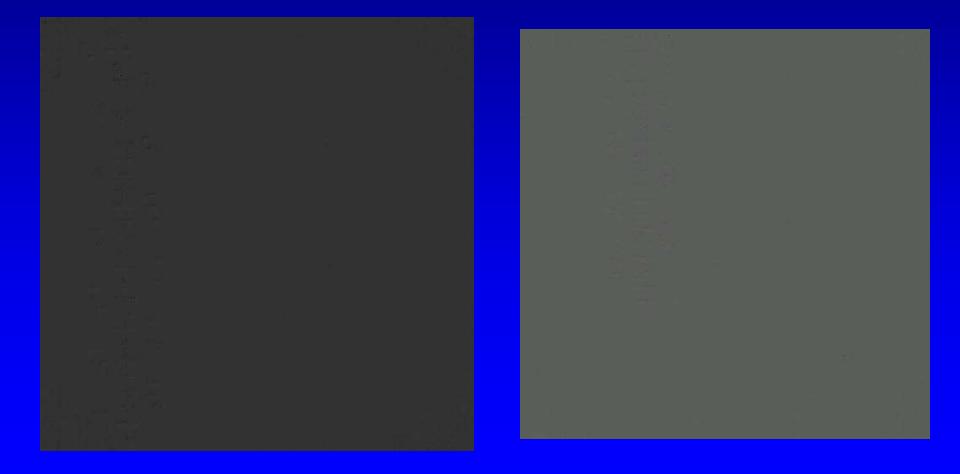




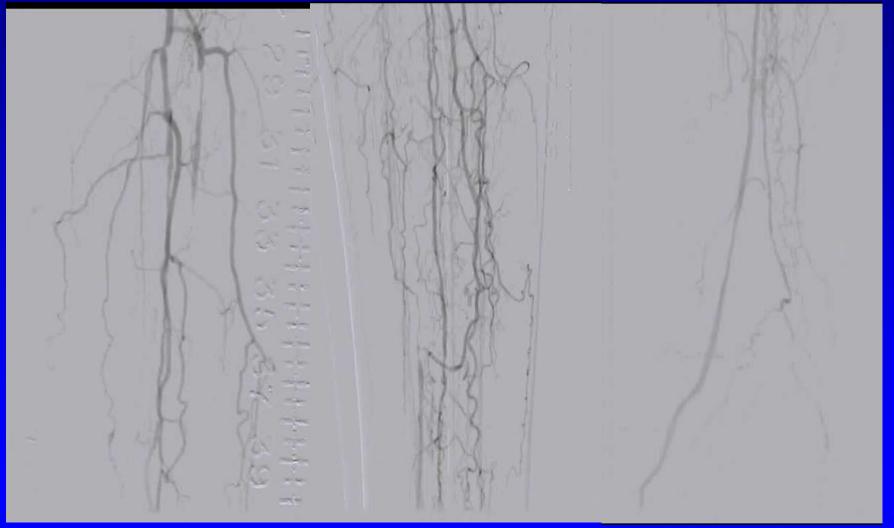


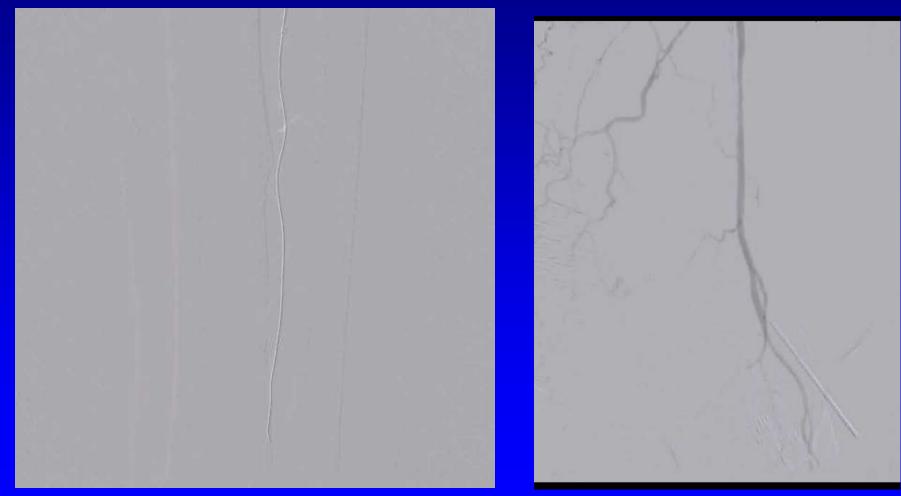




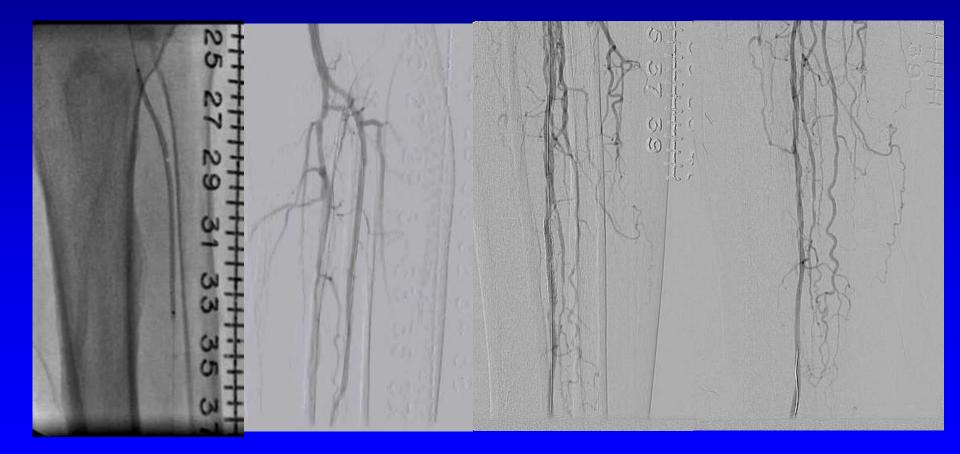












### **PTA in Limb Ischemia** *Pharmacology During the Procedure*

- Treatment of Spasm
- Anticoagulation
- Antiplatelets agents •

- Heparin
- Bivalirudin
- Additional bolus

- Aspirin
- Clopidogrel
- GP 2b/3a
- Prasugrel

Thank you

## Thank you