

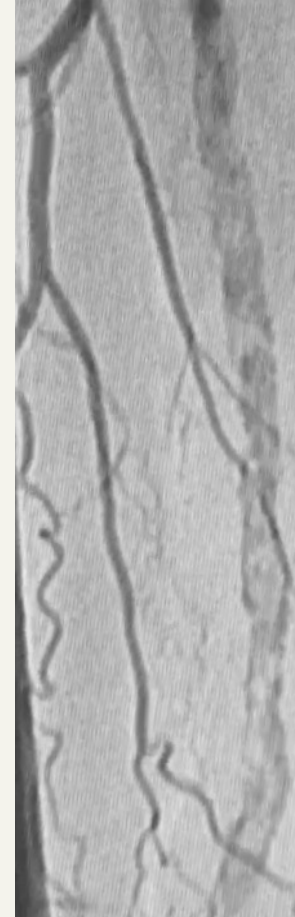
**Simposio ENDOLIMB Rosario 2023**

“Todo sobre enfermedad vascular periférica”

# Batalla contra el Calcio

Dra. Ana Paula Mollón

Cardióloga Intervencionista.

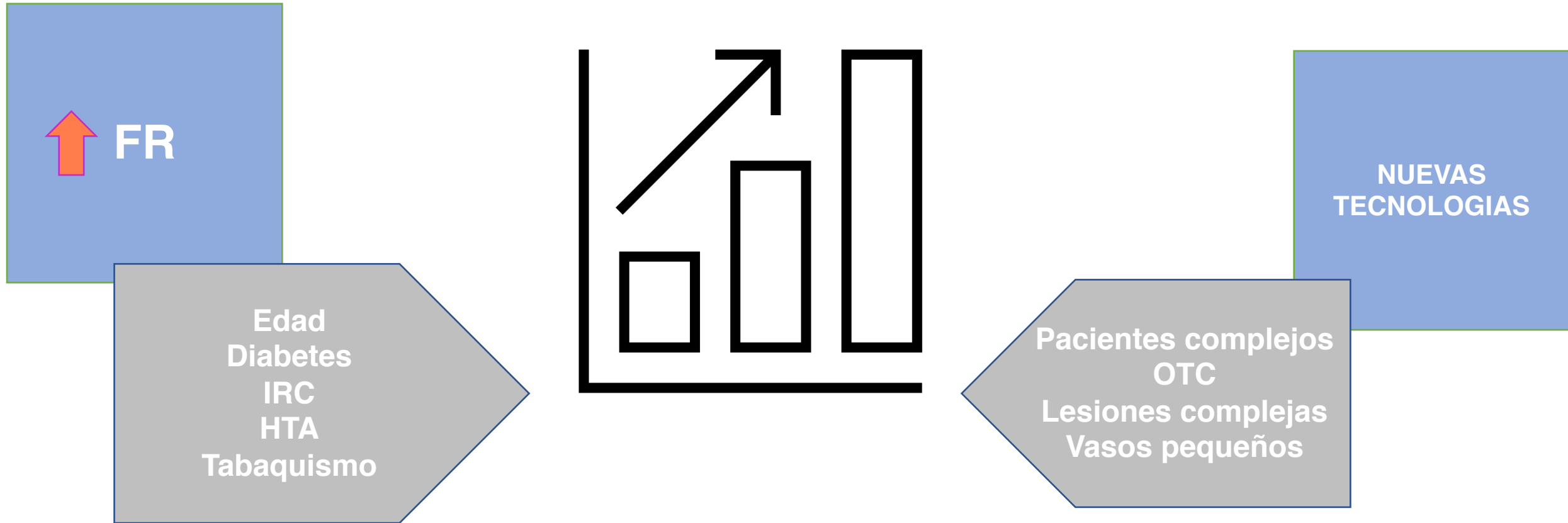


# Cuando tratamos SFA-Pop:

---

- Hay calcio y debemos ocuparnos de tratarlo?
- Tuvo buena respuesta a la preparación del vaso?
- Cual es el riesgo de reestenosis ?

# La necesidad de tratar el calcio crece...



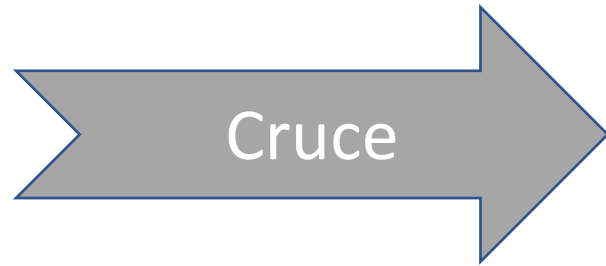
Kassimis G, et al. Shockwave Intravascular Lithotripsy for the Treatment of Severe Vascular Calcification. *Angiology*. 2020;71(8):677-88.

Madhavan MV et al.. Efficacy and safety of intravascular lithotripsy for the treatment of peripheral arterial disease: An individual patient-level pooled data analysis. *Catheter Cardiovasc Interv*. 2020;95(5):959-68

*Arterioscler Thomb Vasc Biol* 2018;38:e48-57

*J Endovasc Ther*. 2022 Jun;29(3):438-443

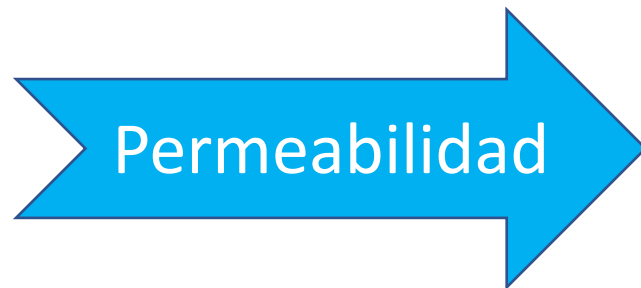
# Desafíos del calcio en el tratamiento endovascular



Anterógrado o retrógrado  
En la reentrada subintimal



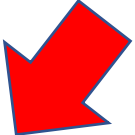
Reduce la ganancia de lumen



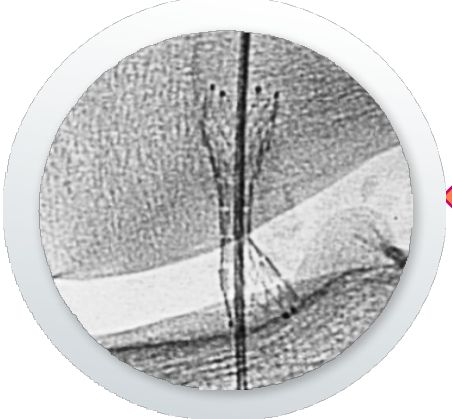
Condiciona la permeabilidad  
corto y largo plazo

# Los problemas que genera el calcio

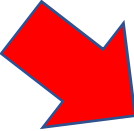
Infraexpansión



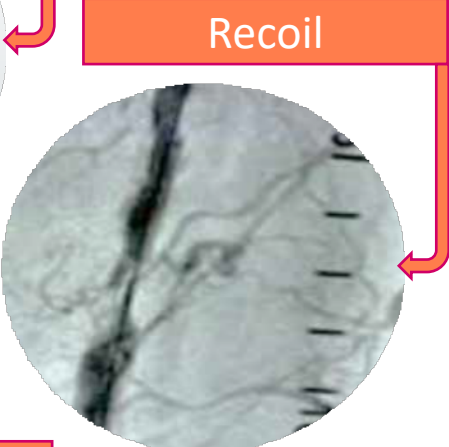
Mala expansión



Sobreexpansión



Disecciones



Recoil



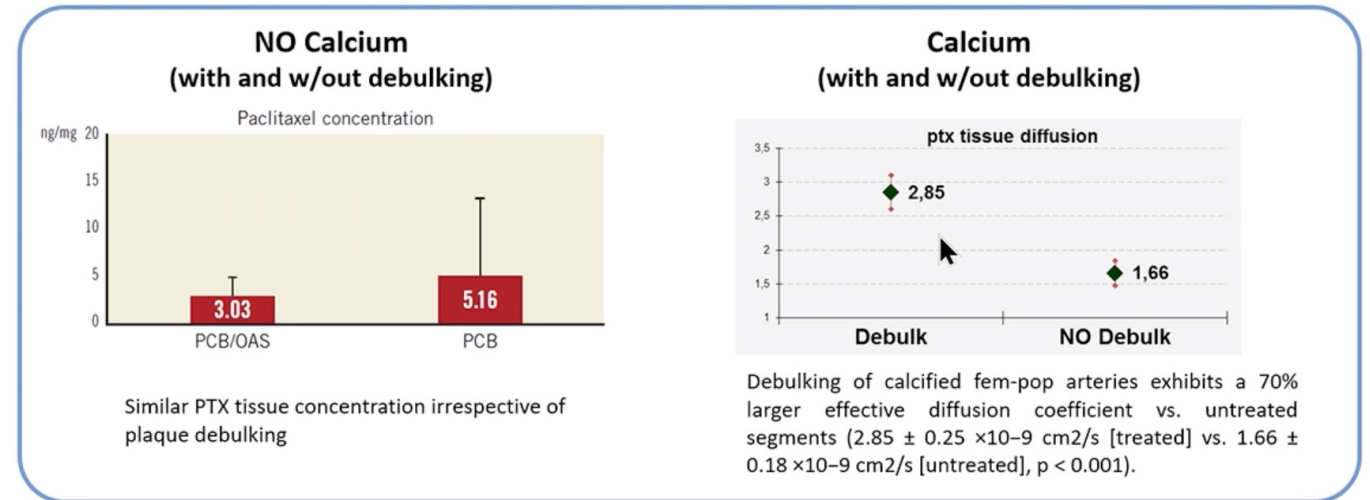
Perforaciones

# Los problemas que genera el calcio



## DCB and Calcium

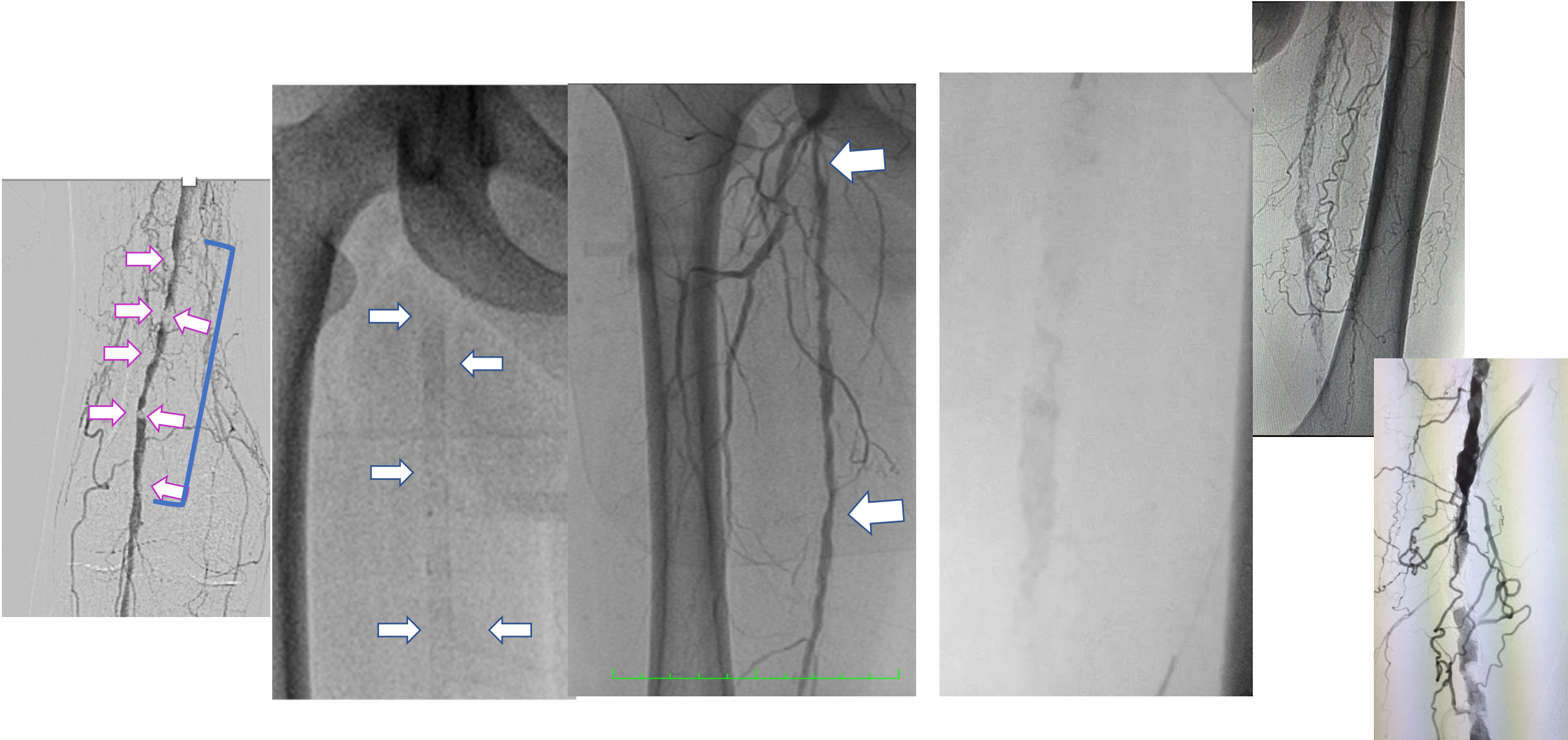
Ex-vivo and pre-clinical experiments confirm Calcium, not plaque burden, remains the real barrier for DCB drug uptake



Mala tolerancia con run-off pobre

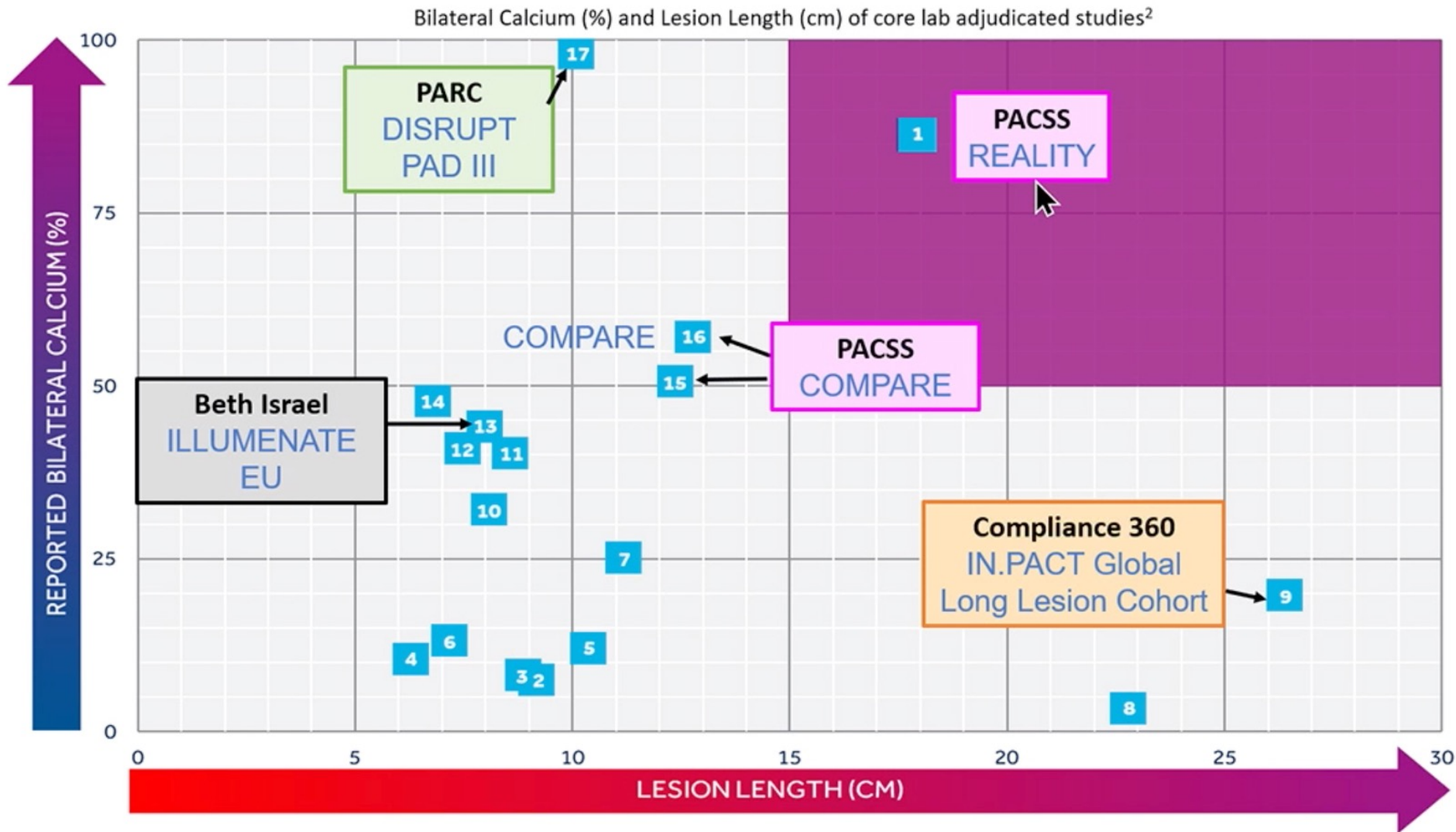
1. Tzafiriri AR, Garcia-Polite F, Zani B, Stanley J, Muraj B, Knutson J, Kohler R, Markham P, Nikanorov A, Edelman ER. Calcified plaque modification alters local drug delivery in the treatment of peripheral atherosclerosis. *J Control Release*. 2017 Sep 1;264:203-210
2. Tellez A, Dattilo R, Mustapha JA, Gongora CA, Hyon CM, Palmieri T, Rousselle S, Kaluza GL, Granada JF. Biological effect of orbital atherectomy and adjunctive paclitaxel-coated balloon therapy on vascular healing and drug retention: early experimental insights into the familial hypercholesterolaemic swine model of femoral artery stenosis. *EuroIntervention*. 2014 Dec;10(8):1002-8

# De que hablamos cuando hablamos de calcio severo?



# USO DE DIFERENTES SCORES $Ca^{++}$

SON COMPARABLES??





# Preparación del vaso → revascularización exitosa

## Maximizar la ganancia del lumen

- Evaluar adecuadamente el tamaño del vaso
- Composición de la placa (debulking/IVL)
- ATP final balón 1:1 vaso

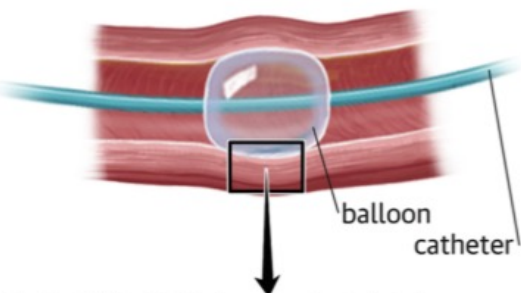
## Perdurable

- Evaluar en el resultado de la preparación
- Detectar y resolver complicaciones recoil – disecciones
- DCB primera opción terapéutica

## Seguro

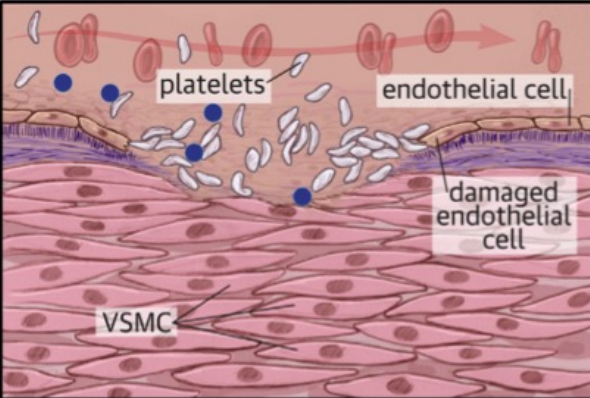
- Evitar barotrauma
- Limitar el impacto pared vaso
- Evitar embolización

# Respuesta del endotelio a la PTA con balón

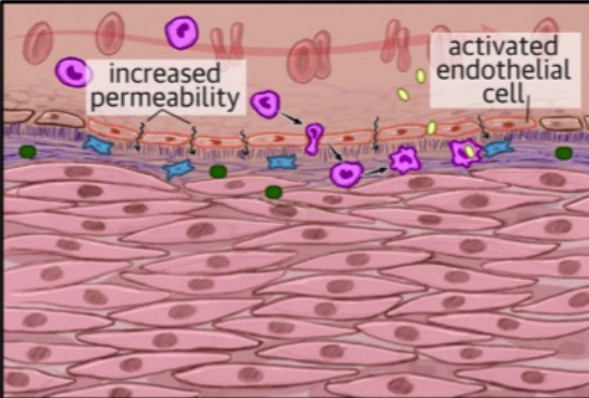


- tissue factor
- fibroblast
- myofibroblast
- growth factor
- LDL
- monocyte
- macrophage
- foam cell
- VSMC-derived foam cell

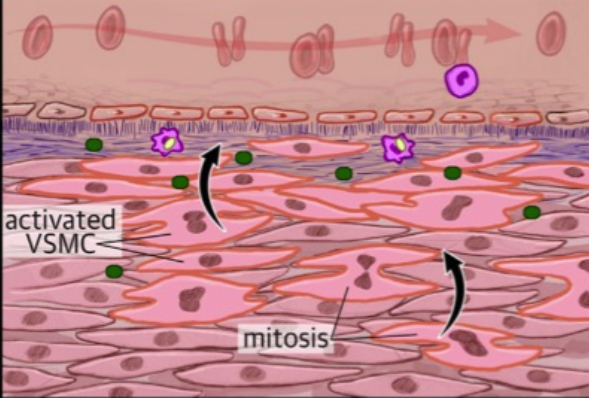
1. Endothelial injury and platelet aggregation (after removal of balloon)



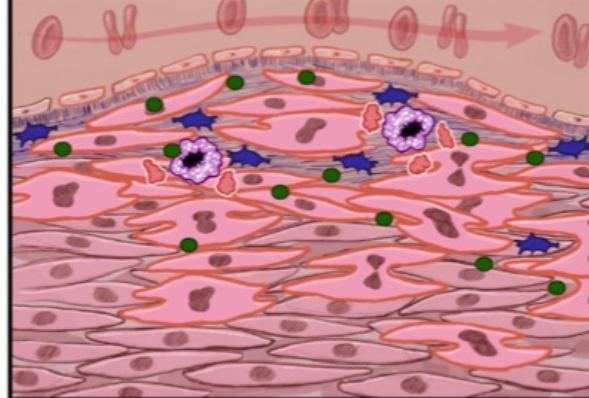
2. Endothelial dysfunction and leukocyte adhesion



3. Smooth muscle cell migration and proliferation



4. Formation of neointima

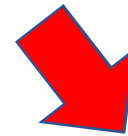
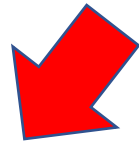


# La delgada línea roja....encontrar el equilibrio que hacemos en lesiones calcificadas?

Infraexpansión



Sobreexpansión



Elegir inadecuadamente el diámetro

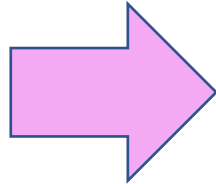
**Mala referencia  
diámetro vaso**

Complicaciones por sobreesfuerzos –  
perforación de la pared –  
restricción de flujo –  
el revascularizado comprometen el resultado a largo plazo

**Falla por detección  
complicaciones**

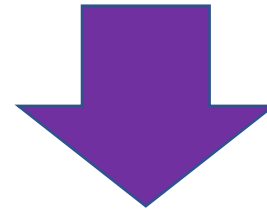
# Recoil es resultado barotrauma

- Estiramiento con el balón
- Remueve el endotelio
- Rompe la lámina interna
- Injuria en la media



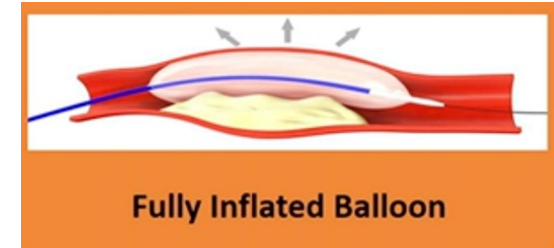
15 minutos

Injuria inmediata = Recoil  
Fuerzas elásticas de la pared y células del musculo liso



Largo plazo predictor

Remodelación negativa  
Hiperplasia miointimal  
**REESTENOSIS**

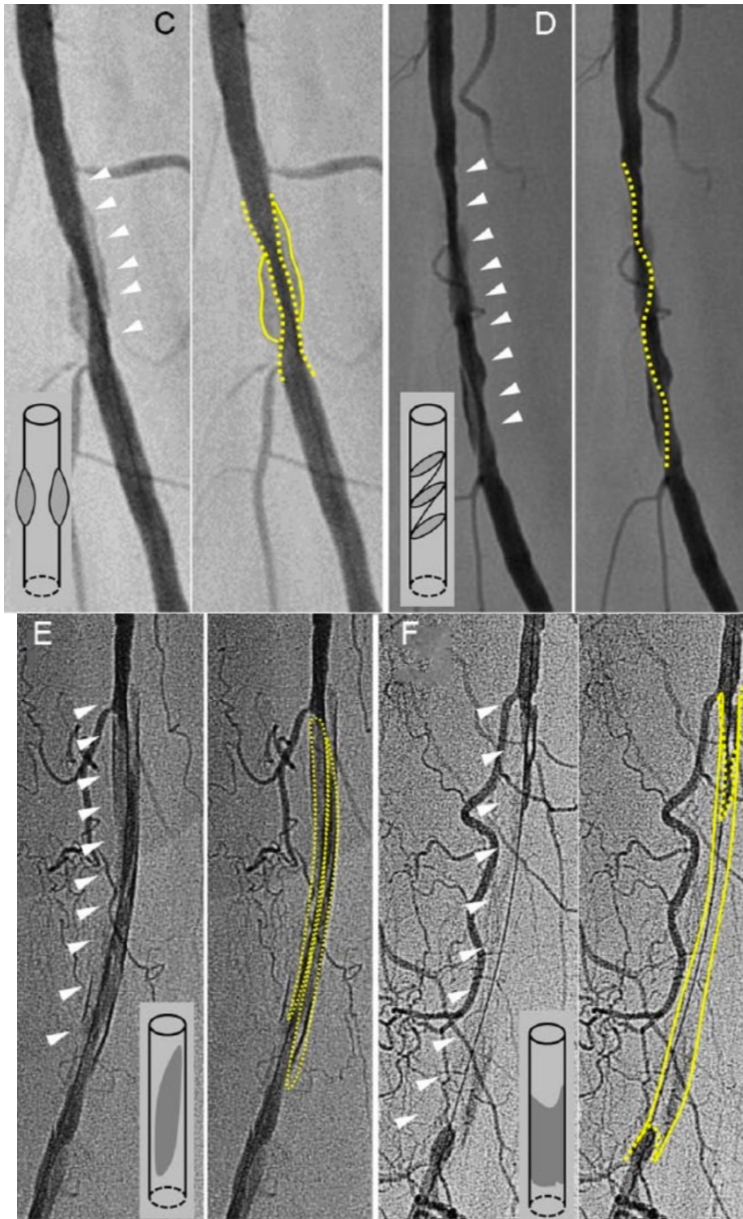


Reducción del lumen de  $\cong 30\%$

# Disección severas

Fujihara M, Takahara M, Sasaki S, et al. Angiographic dissection patterns and patency outcomes after balloon angioplasty for superficial femoral artery disease. J Endovasc Ther. 2017;24:367-375.

## Eventos a largo plazo



THUNDER Study<sup>1</sup>  
Overall Dissection Rate = 31.1 %

	TLR at 6m	TLR at 24m
No Post-PTA Dissection	10.5%	NR
Grade A-B (n=34)	33%	43%
Grade C-D-E (n=14)	43%	78%

Rates of TLR for A/B SFA dissections reported worse than C/D/E dissections at 12 months

Fujihara et al<sup>2</sup>  
Overall Dissection Rate = 84.0%

	TLR at 6m	TLR at 12m
No Post-PTA Dissection	14%	25%
Grade A-B (n=314)		
Grade C-D-E-F (n=314)	34%	66%

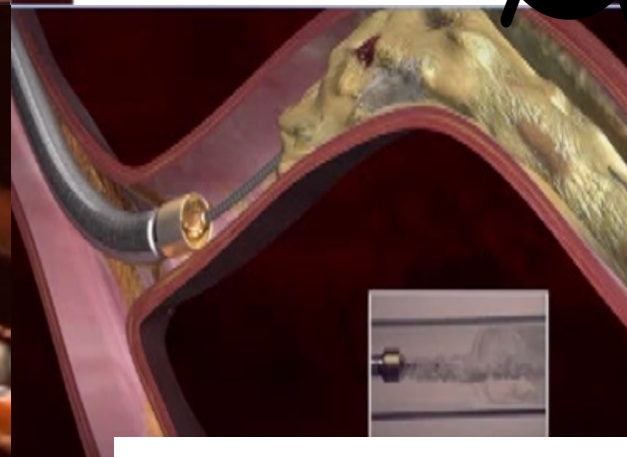
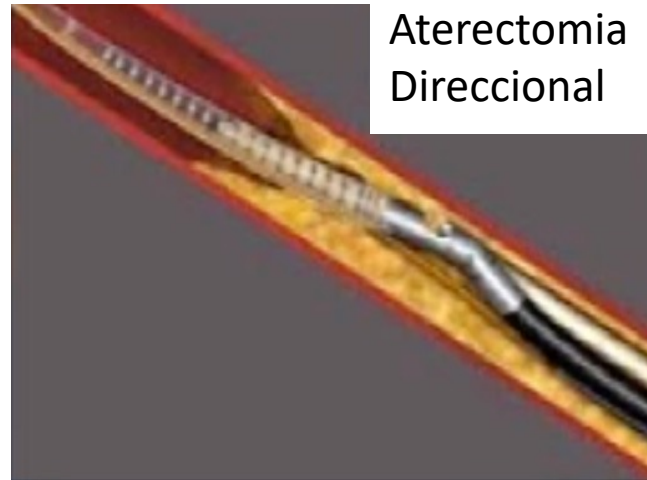
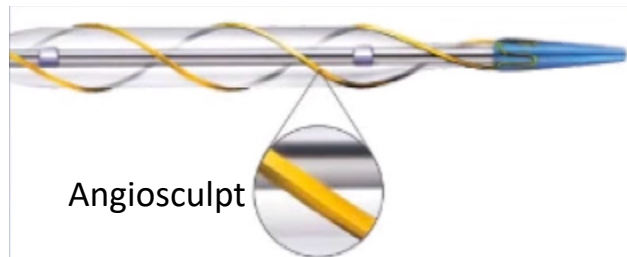
Small diameter, long lesion and vessel occlusion were predictive of high risk for dissection in the SFA

<sup>1</sup>Tepe J Endovasc Ther 2013;20:792-800

<sup>2</sup>Fujihara J Endovasc Ther 2017;1-9

# Tratamiento de las lesiones calcificadas

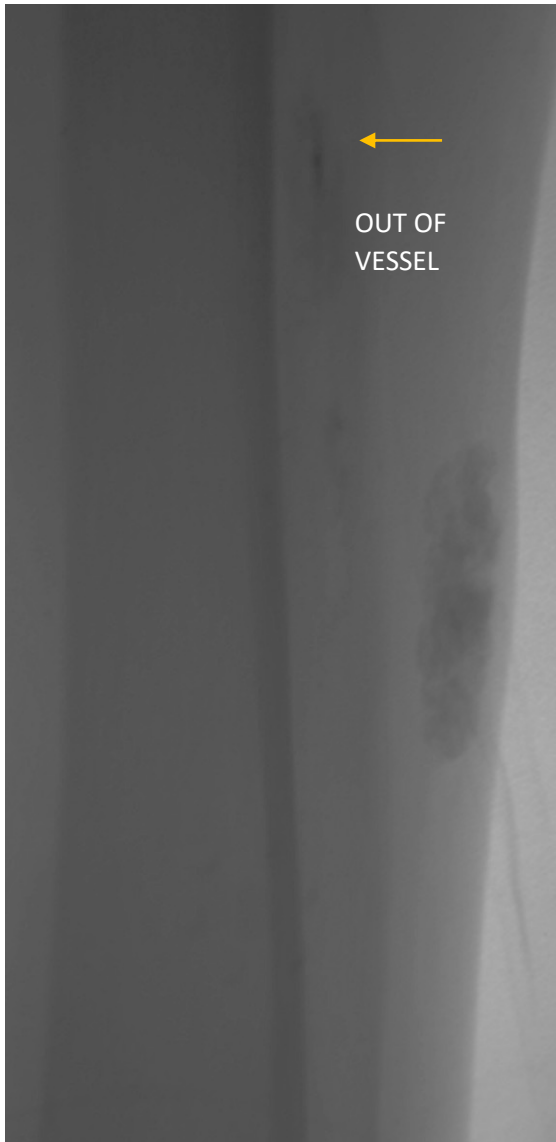
Balones especiales – Debulking -IVL



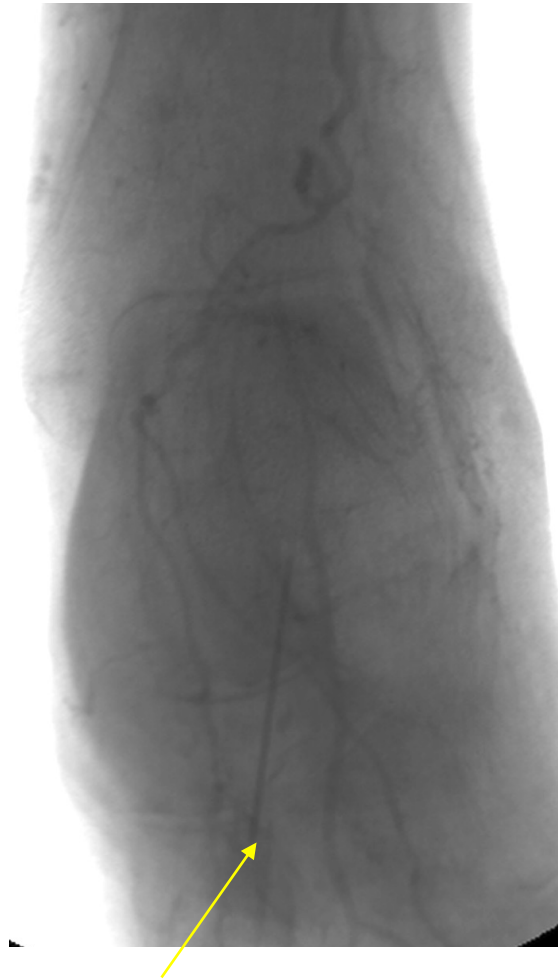
Aspiración activa



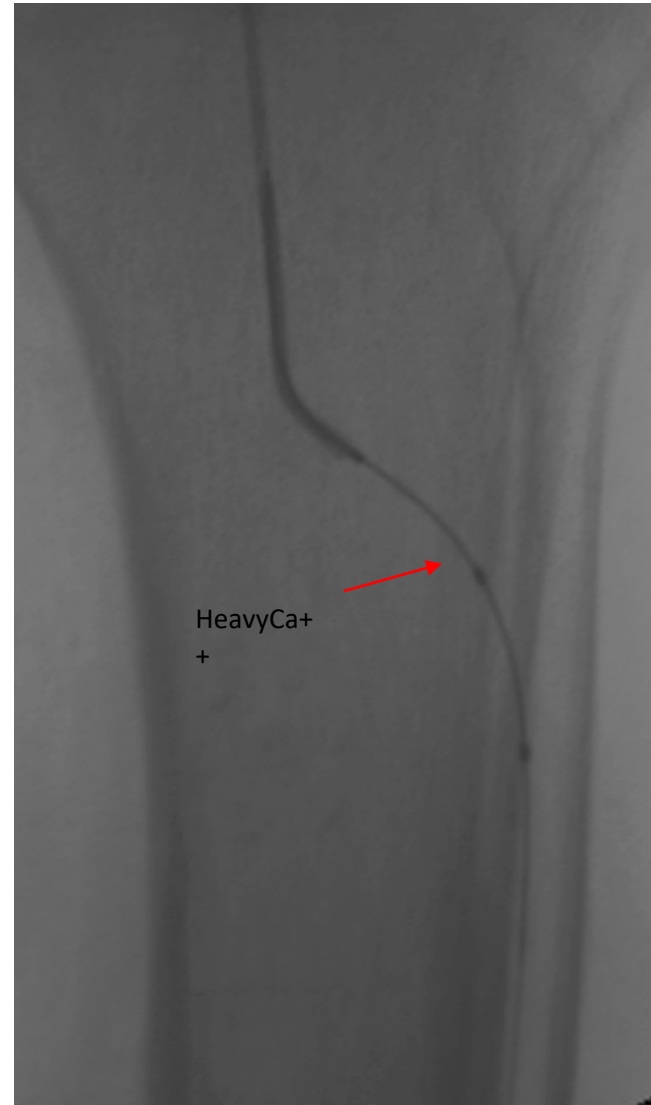
Litotipsia Intravascular Shockwave (IVL)



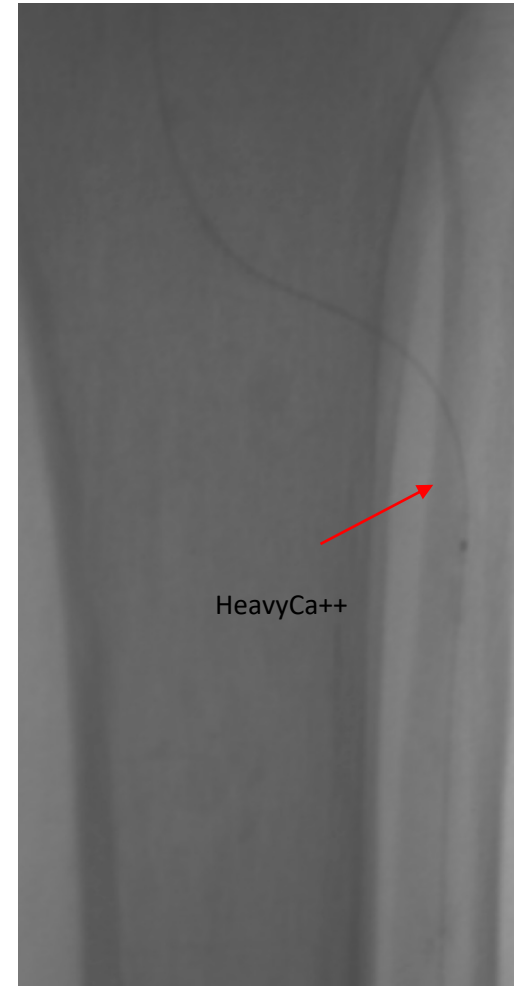
We couldn't cross the occlusion in the medial segment of the Anterior Tibial Artery



Distal approach in the Dorsalis Pedis  
We could connect the two vias

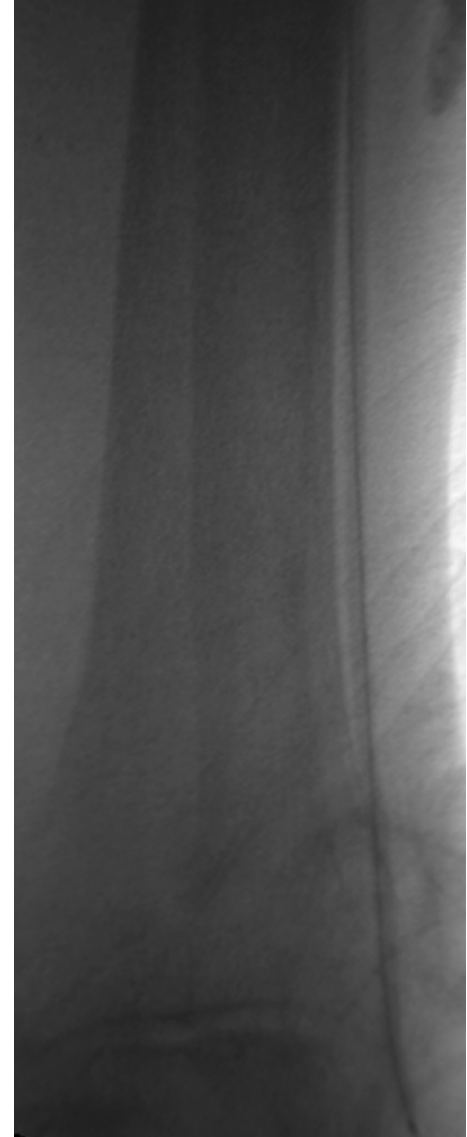
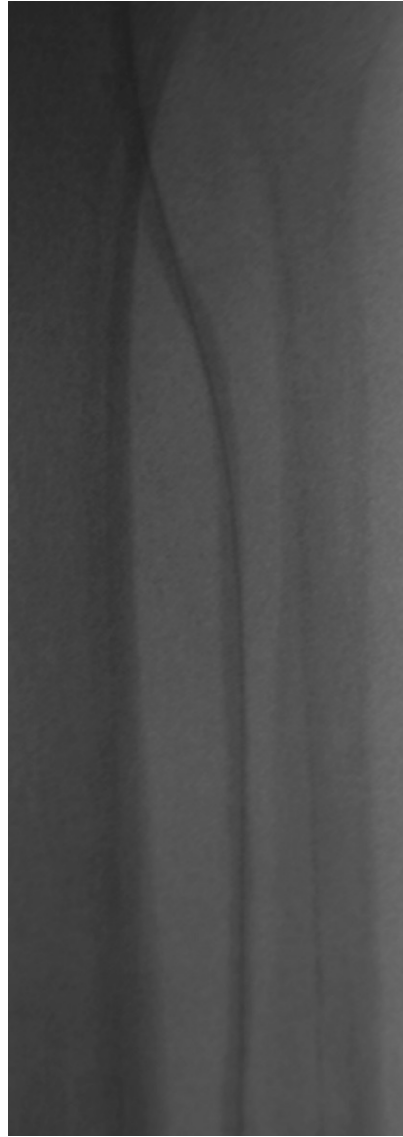
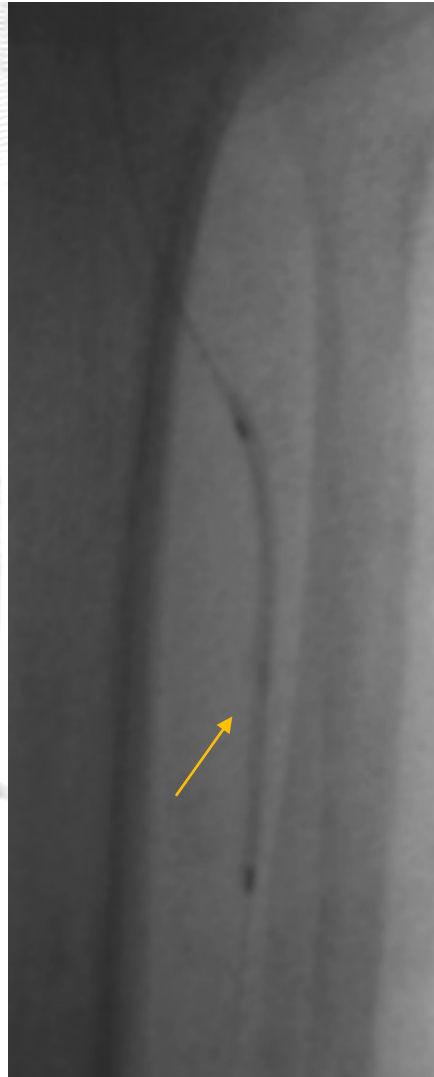
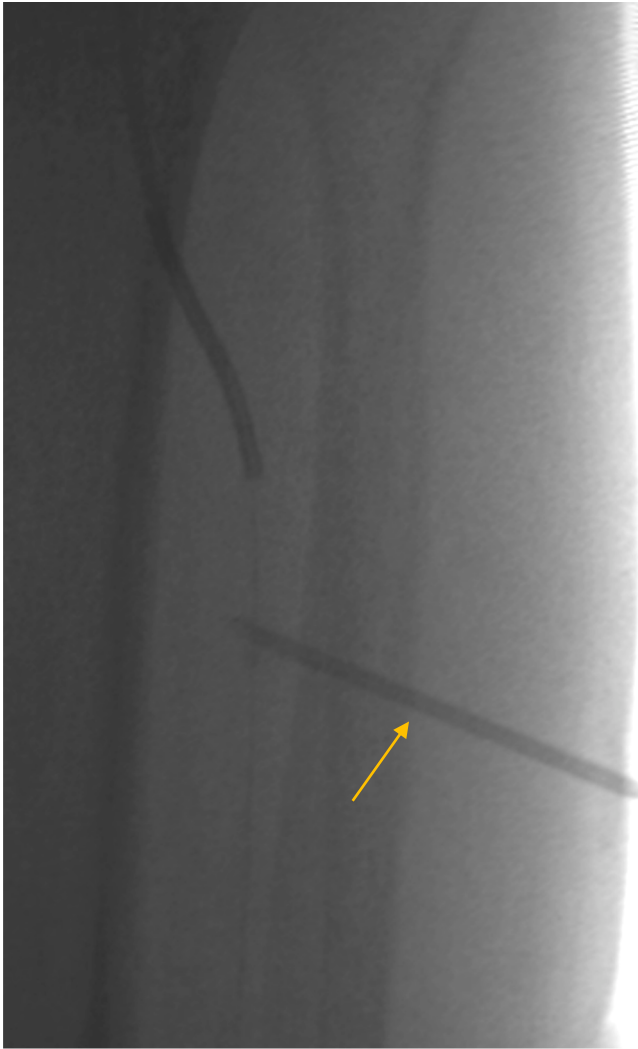


We tried to predilate the proximal anterior tibial artery in a heavy calcified lesion



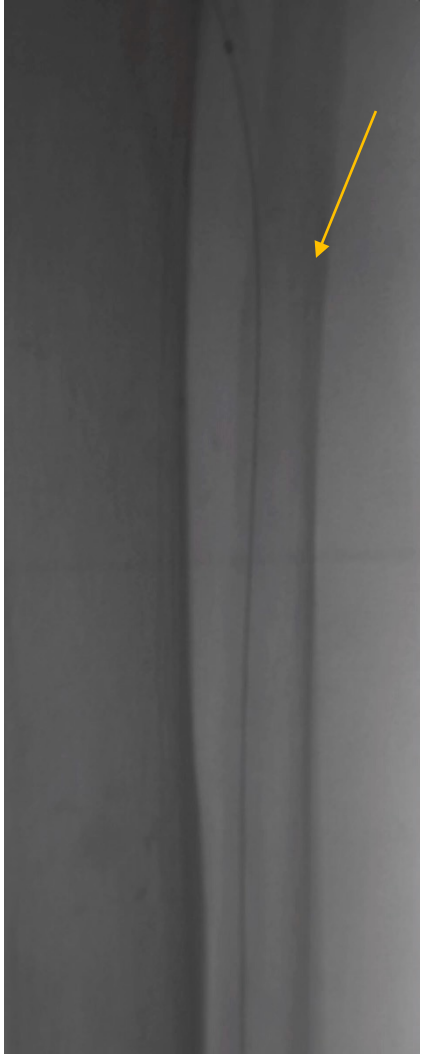
We failed to cross a coronary balloon 1.0 x 5 mm Terumo Ruyei).

# Pierce Technique

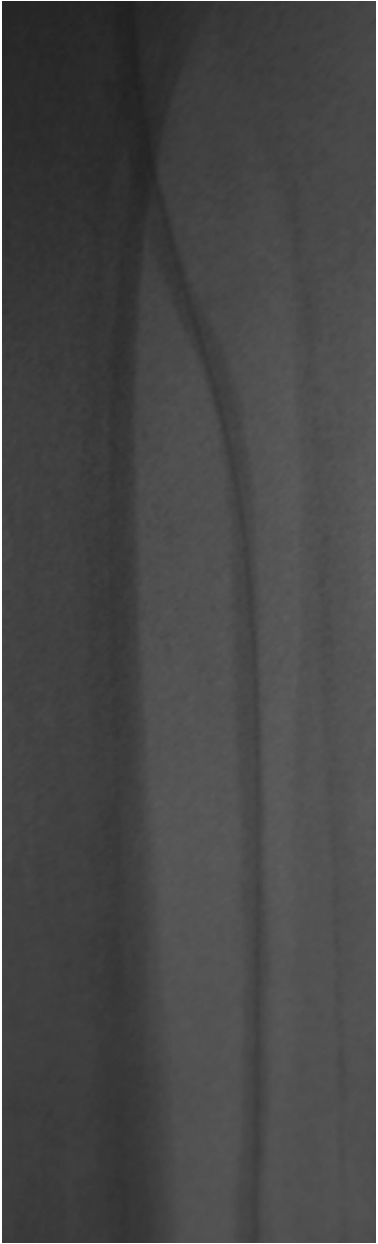


18G needle at the proximal  
segment of the AT artery  
heavy calcified lesion

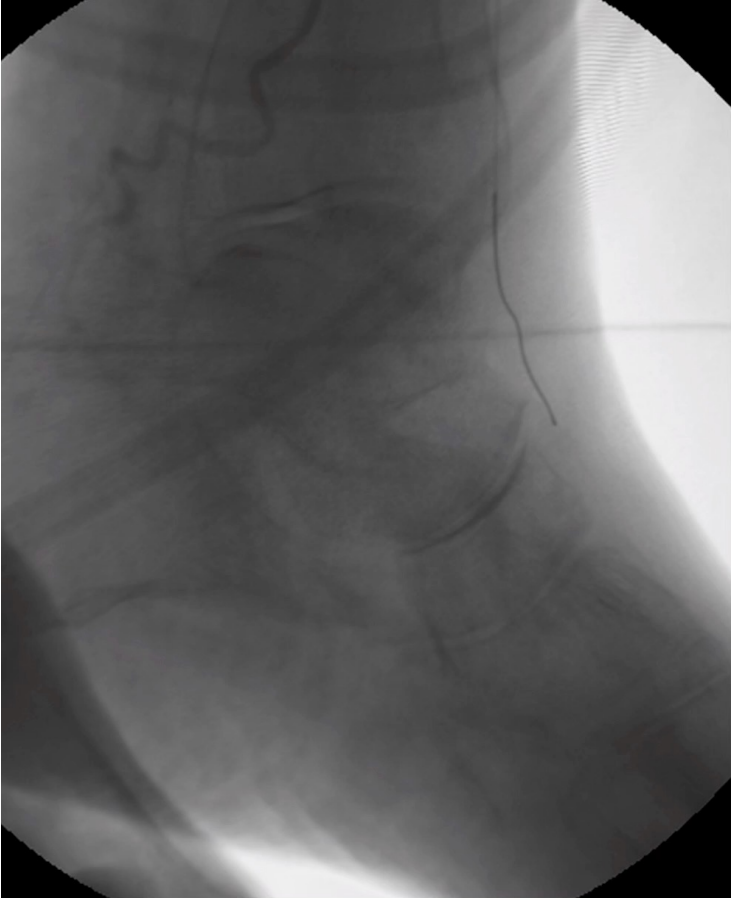
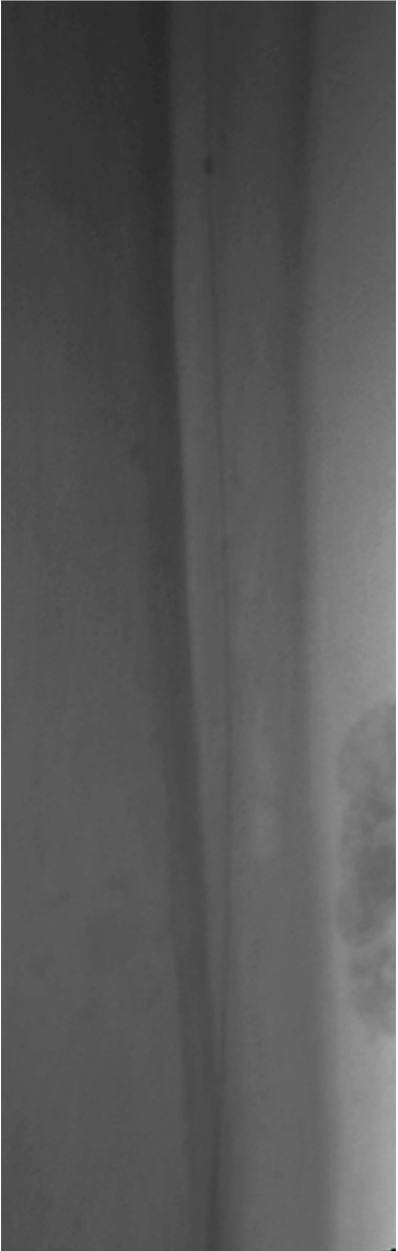
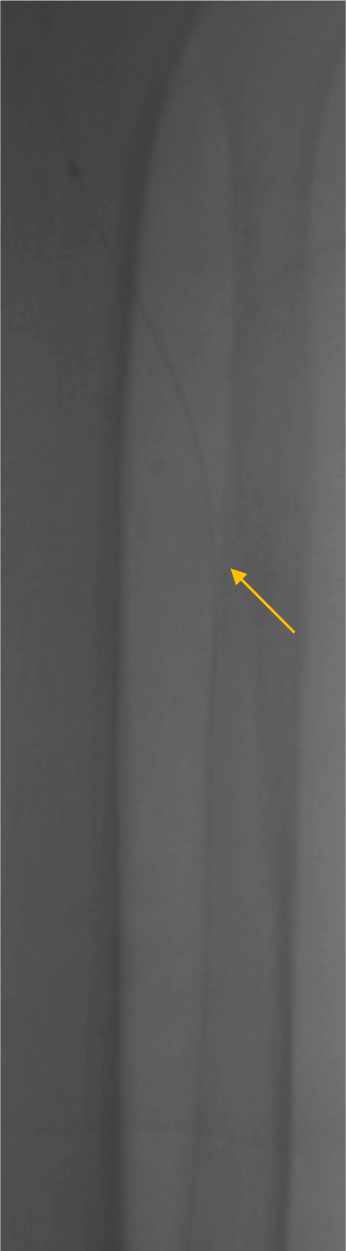




Armada 14 balloon 3.0 x150 mm



Sellution DCB balloon 3.5 x150 mm



# Wound healing

- Full pain improvement
- The patient underwent minor amputation

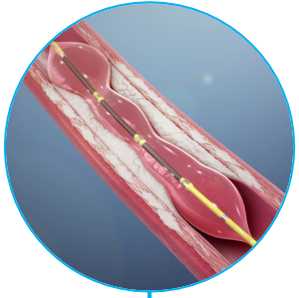
two days



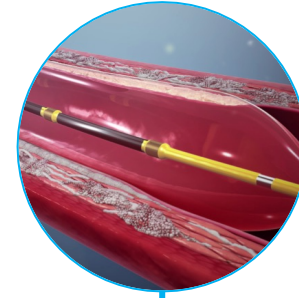
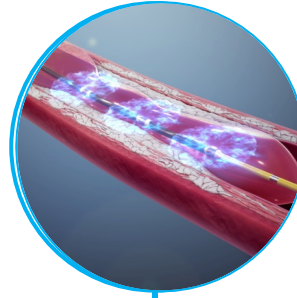
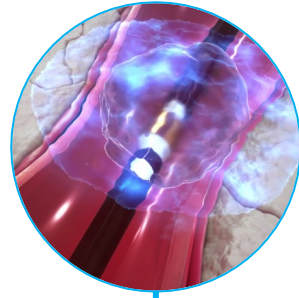
two week



# Litotricia intravascular



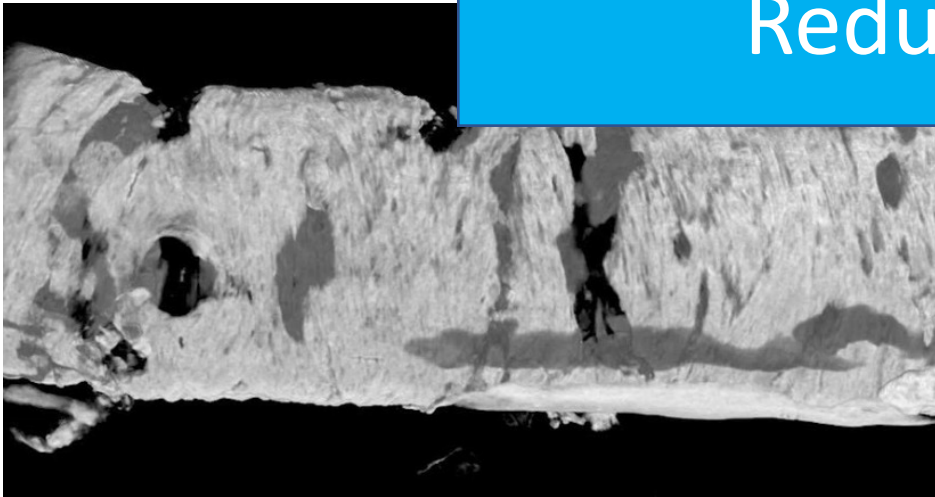
Se introduce un catéter y se infla a baja presión



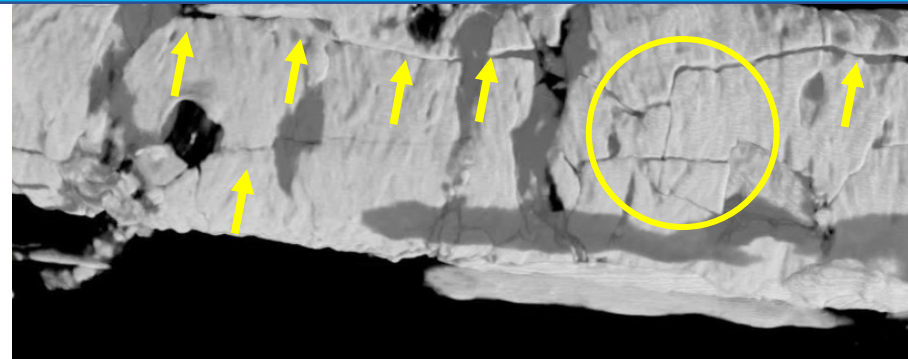
Reducción el barotrauma  
Ganancia lumen  
Reducir la inflamación

## IVL

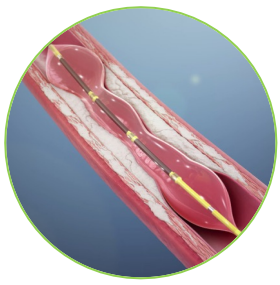
- Emite 1 pulso/s a una presión efectiva de ~50 atm
- Balón mantenido a una presión de inflado baja
- Rompe la calcificación superficial y profunda



Antes del tratamiento con IVL\*

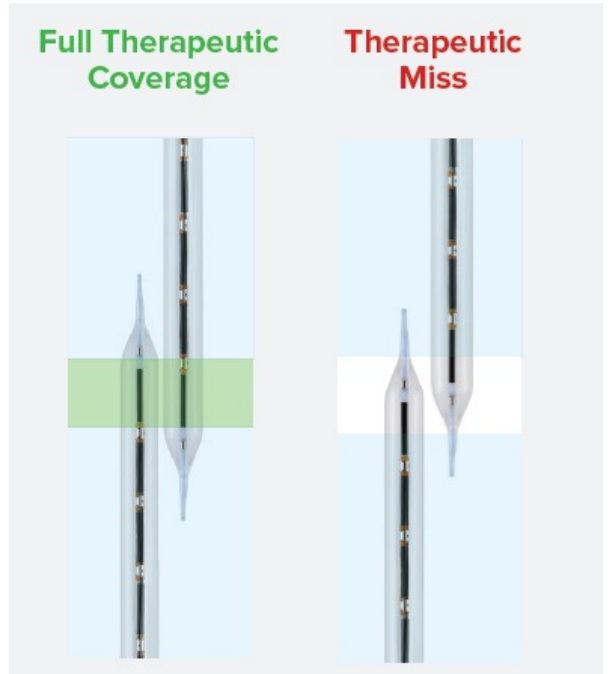


Después del tratamiento con IVL\*



# Litotricia intravascular

Overlapping de 1 cm

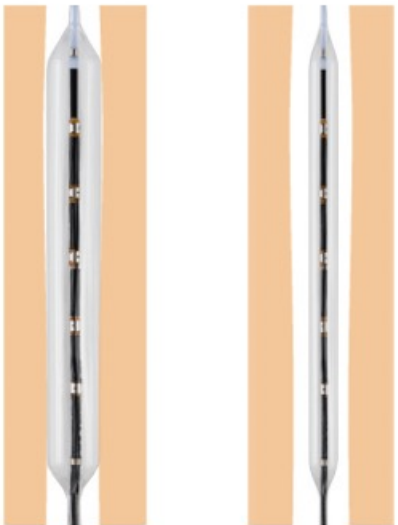


Optimizar el tamaño del balón  
Buen aposicionamiento facilita  
la transferencia de energía

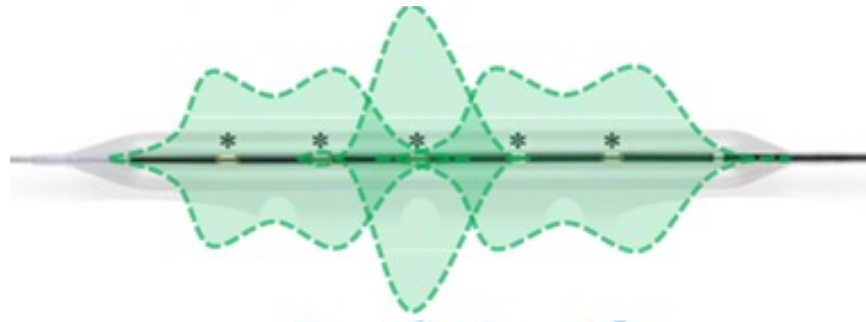
Oversizing 10 %

Optimal

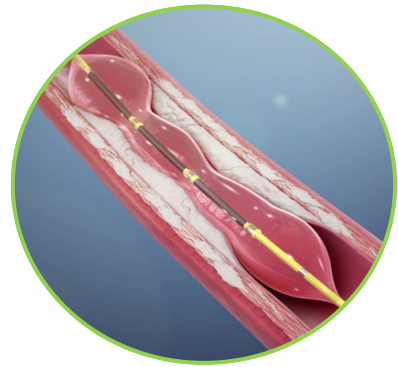
Undersized



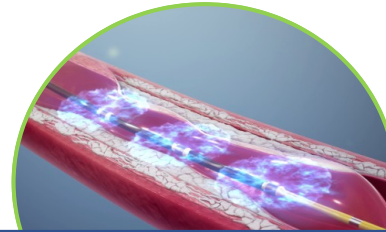
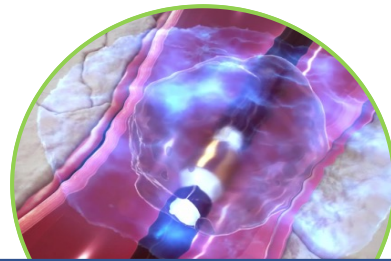
La máxima presión acústica se  
alinea con el emisor principal



# Litotricia intravascular

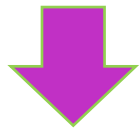


Diámetro de balón IV  
oversizing del 10%  
Asegurarse una buena  
aposición



Lograr adecuado diámetro vaso  
DCB  
Reducir bailout stent

Ciclos hasta obtener el  
necesario con max. 300  
0 ciclos en la misma o  
ferentes lesiones



Se infla a 4 ATM  
baja presión

Fractura o agrieta  
solo el tejido duro como el  
calcio

Continuar tratamiento con DCB

# PAD III: La IVL logró una preparación vascular superior

↓44 %

Mejores resultados con presión más **baja** con IVL

↓75 %

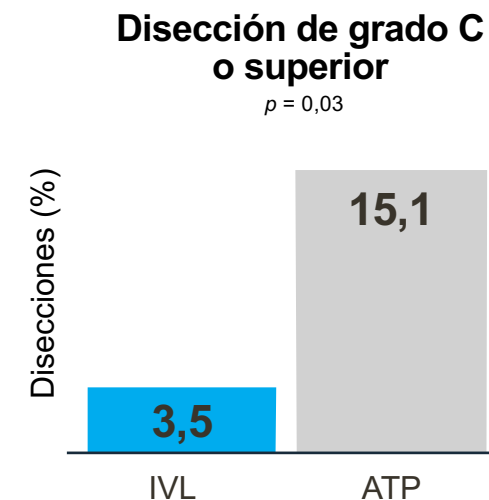
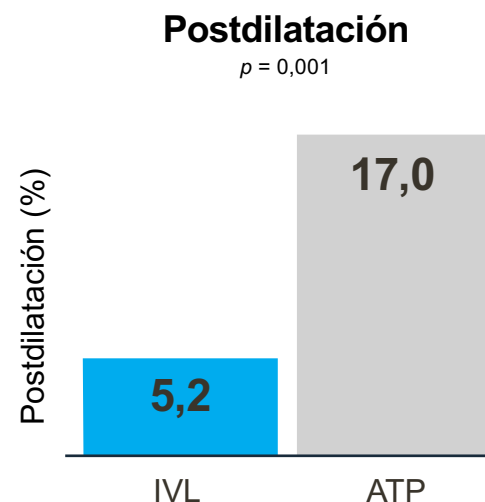
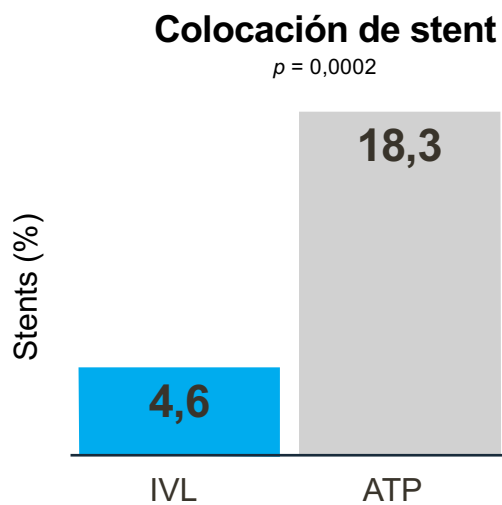
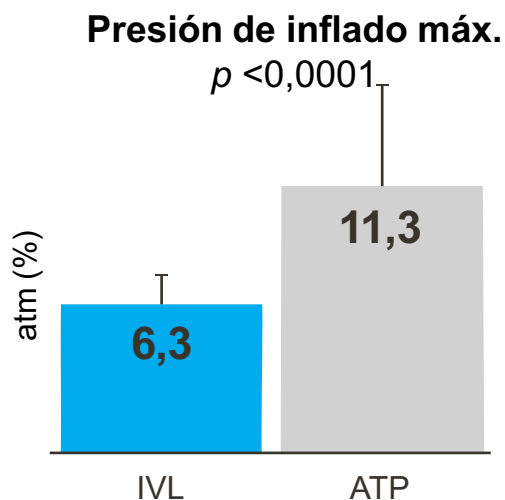
Reducción del riesgo de colocación de **stent** provisional con la IVL

↓69 %

Reducción de la necesidad de **postdilatación** con IVL

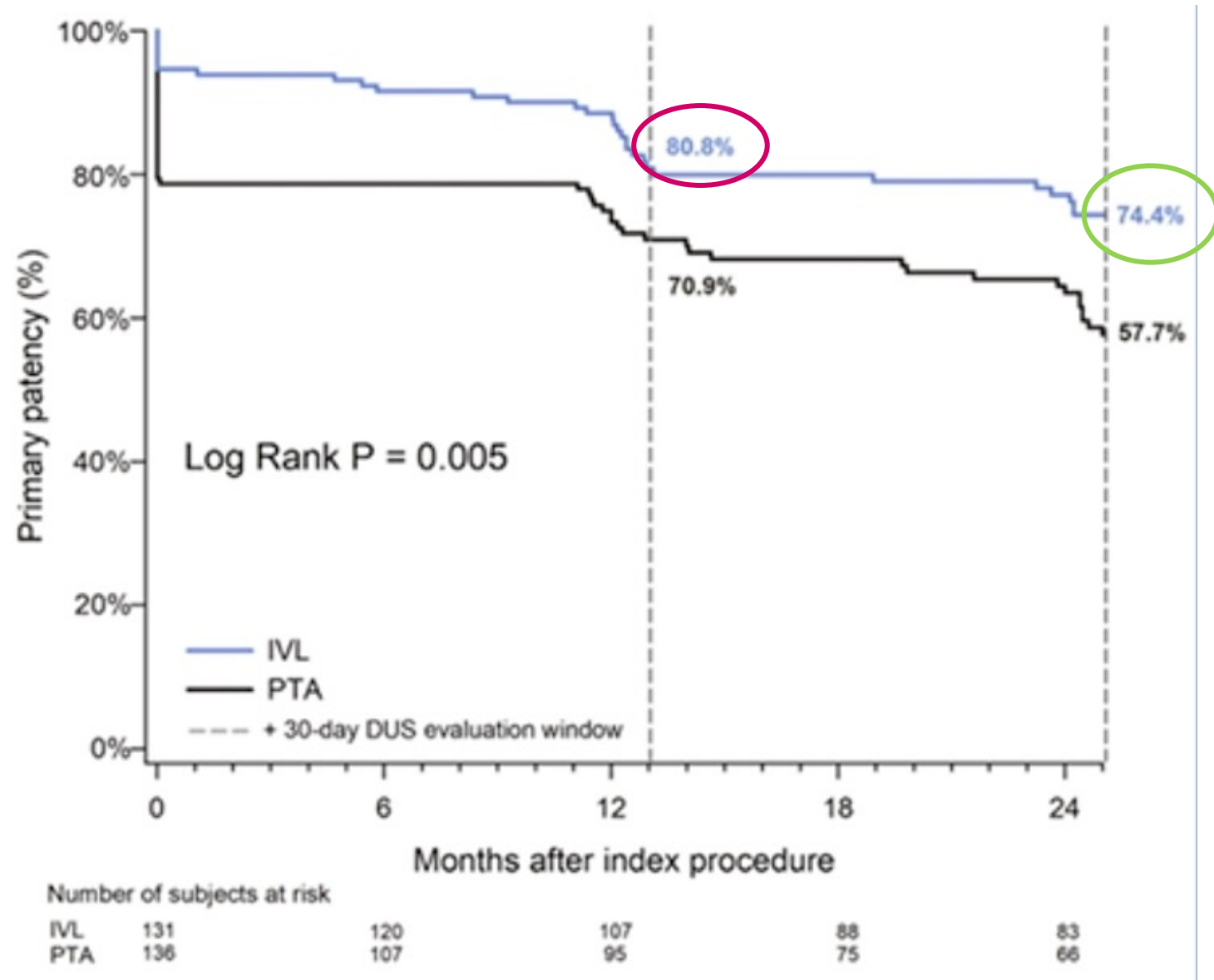
↓77 %

Reducción de **disección** de grado  $\geq C$  con IVL

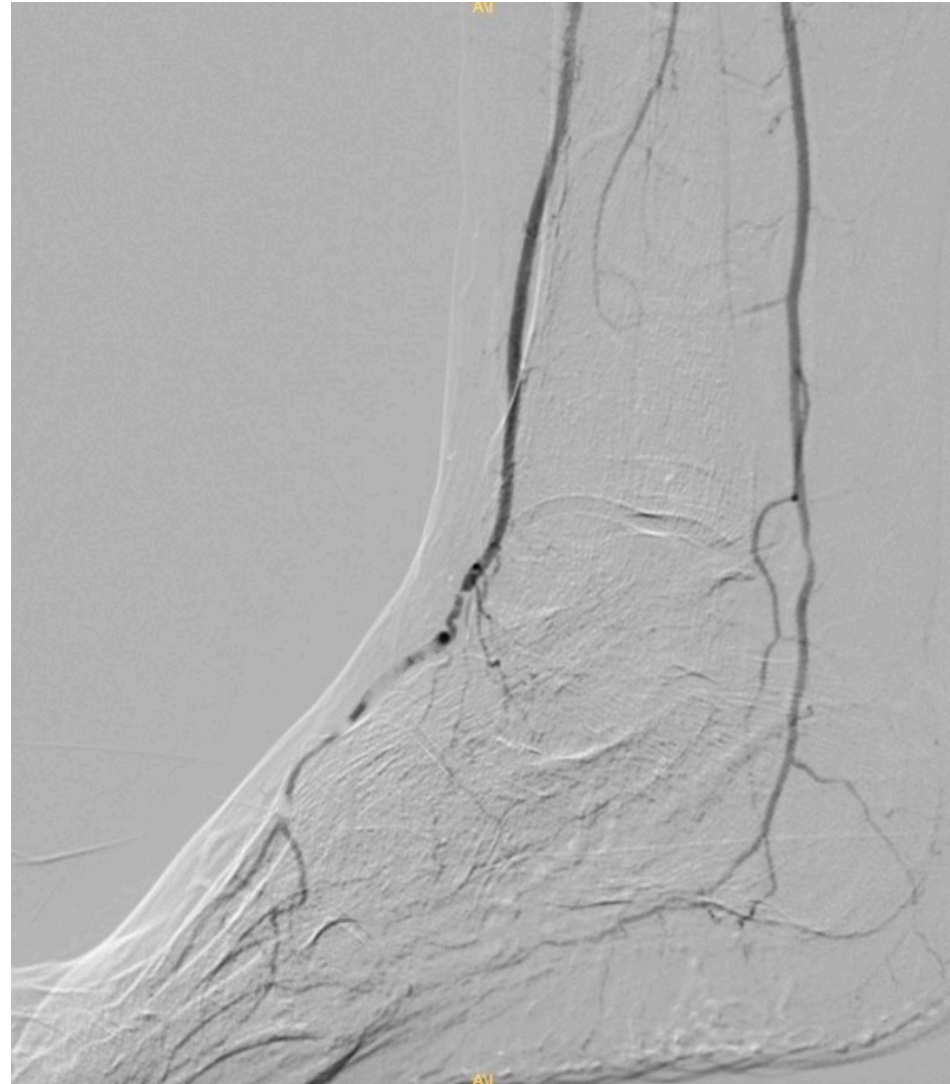
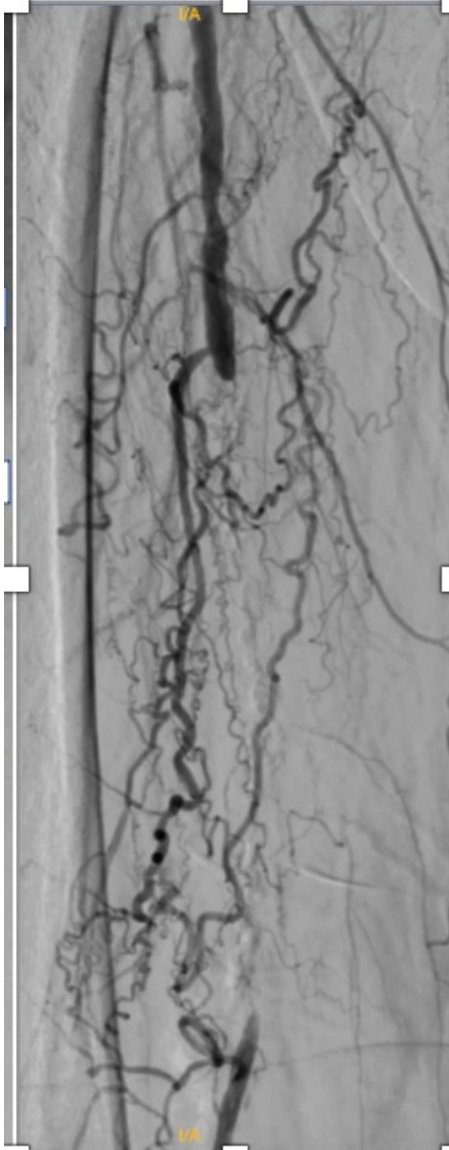


# Permeabilidad primaria a 24 meses

IVL como preparación del vaso para DBC a 2 años



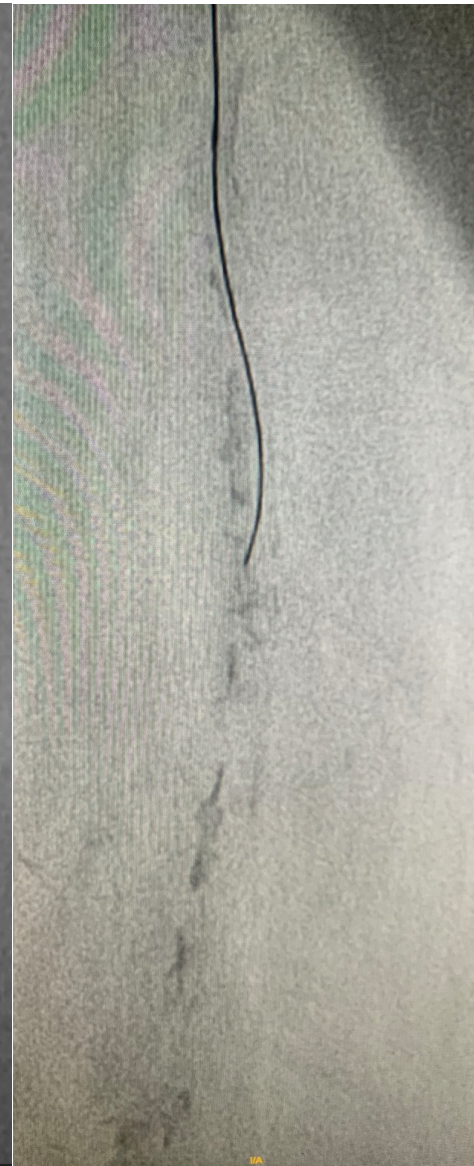
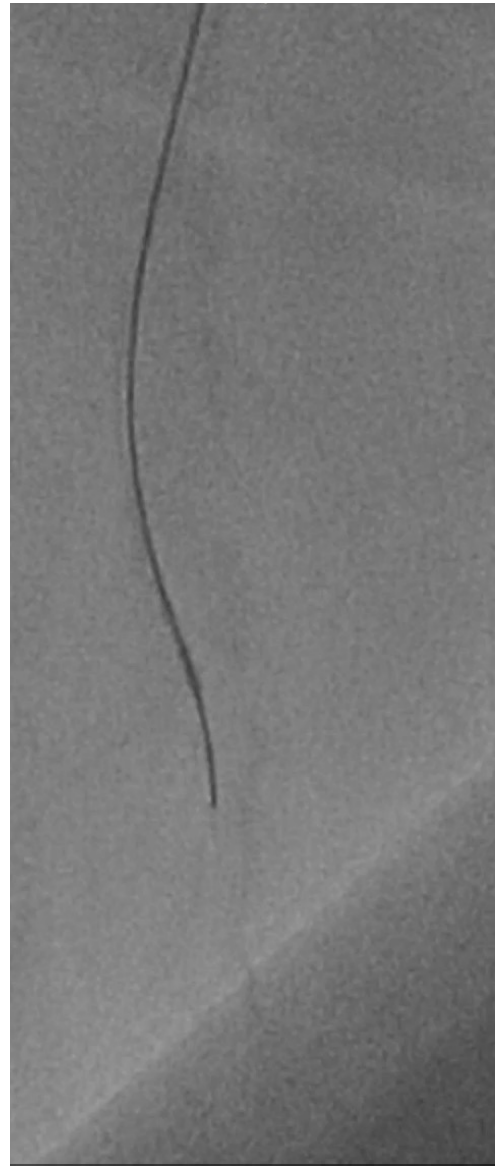
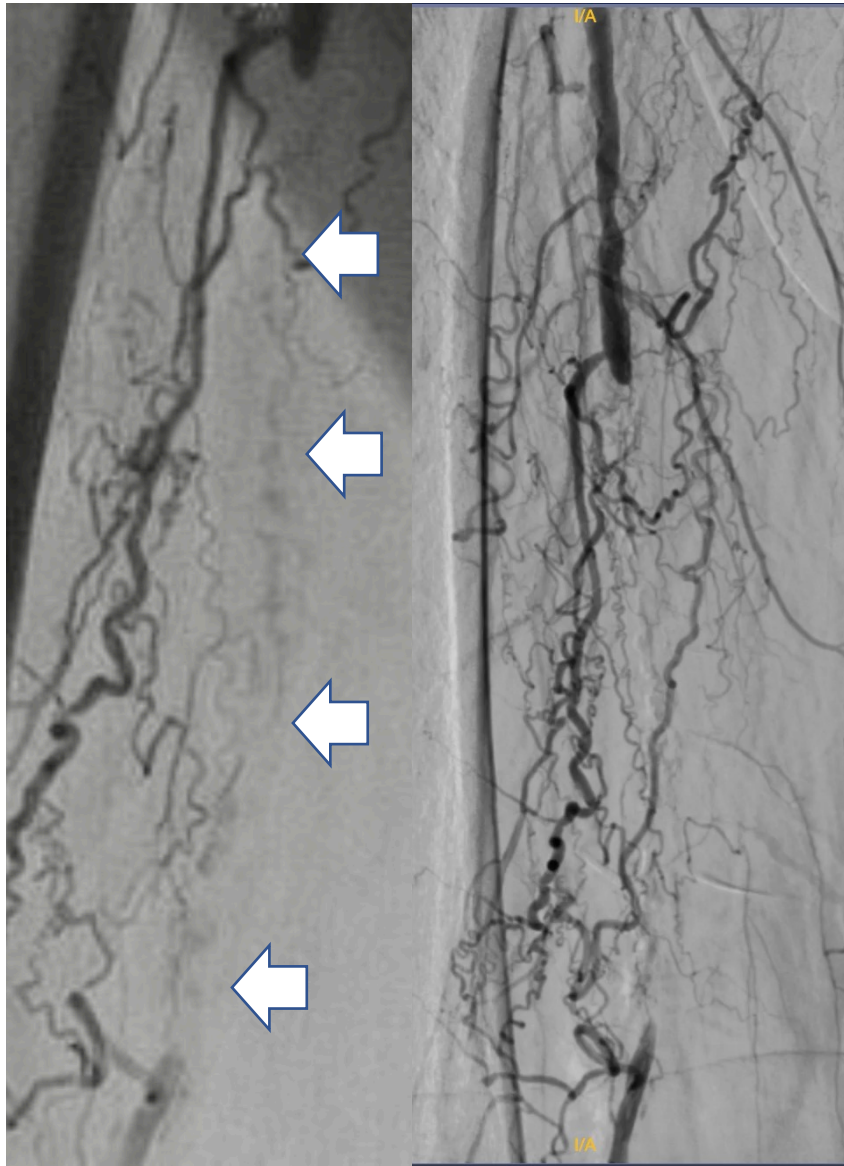
Hombre 67 años HTA, DBT diálisis trisemanal CTLI Rutherford 5  
lesión plantar talón MID  
SFA OTC Severamente calcificada





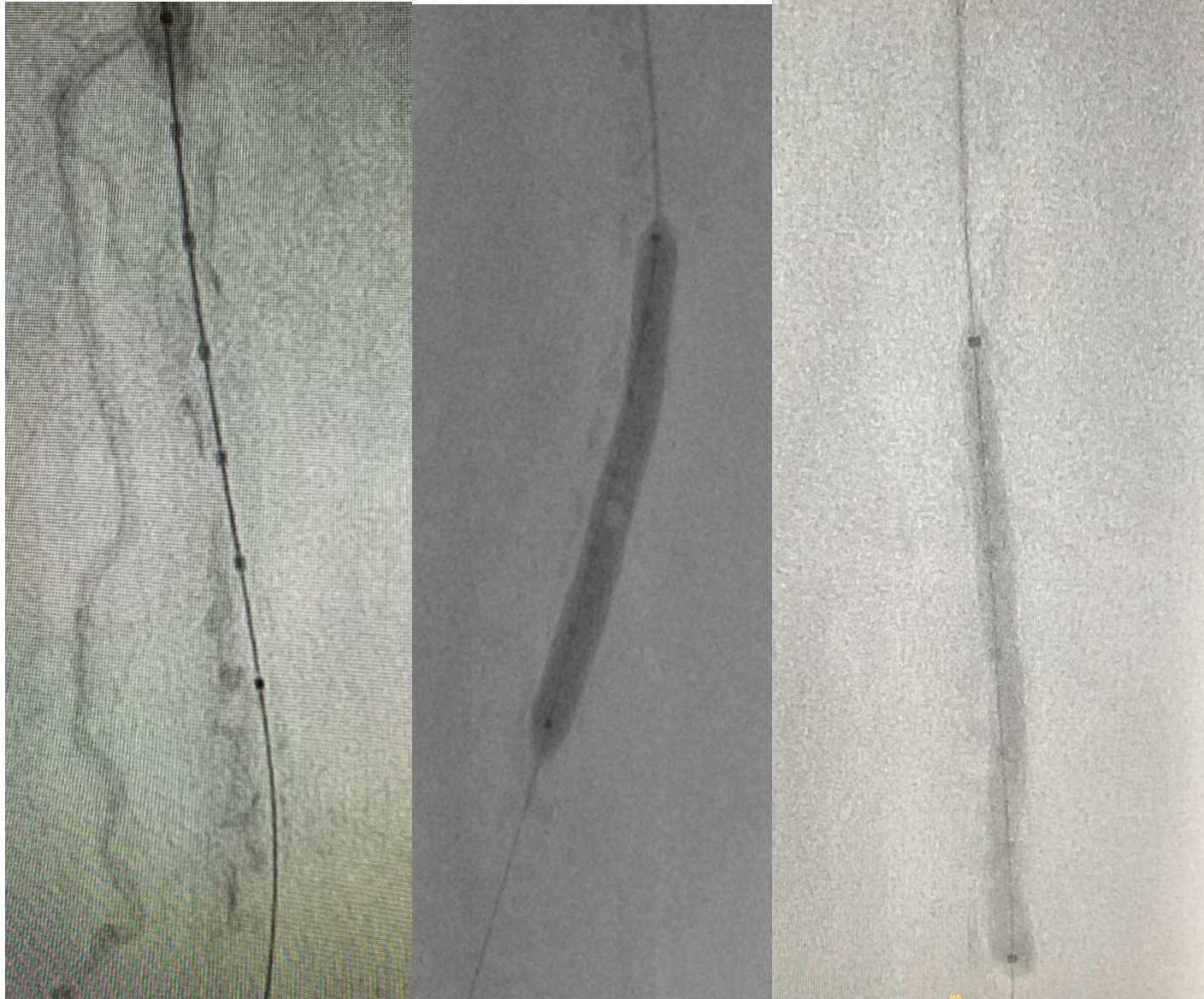
# SFA

Cruce endoluminal Microcateter CXI18Guía + Connect 250T  
Control a través del micro de verdadera luz  
Predilatación con balón 3.0x100mm



IVL

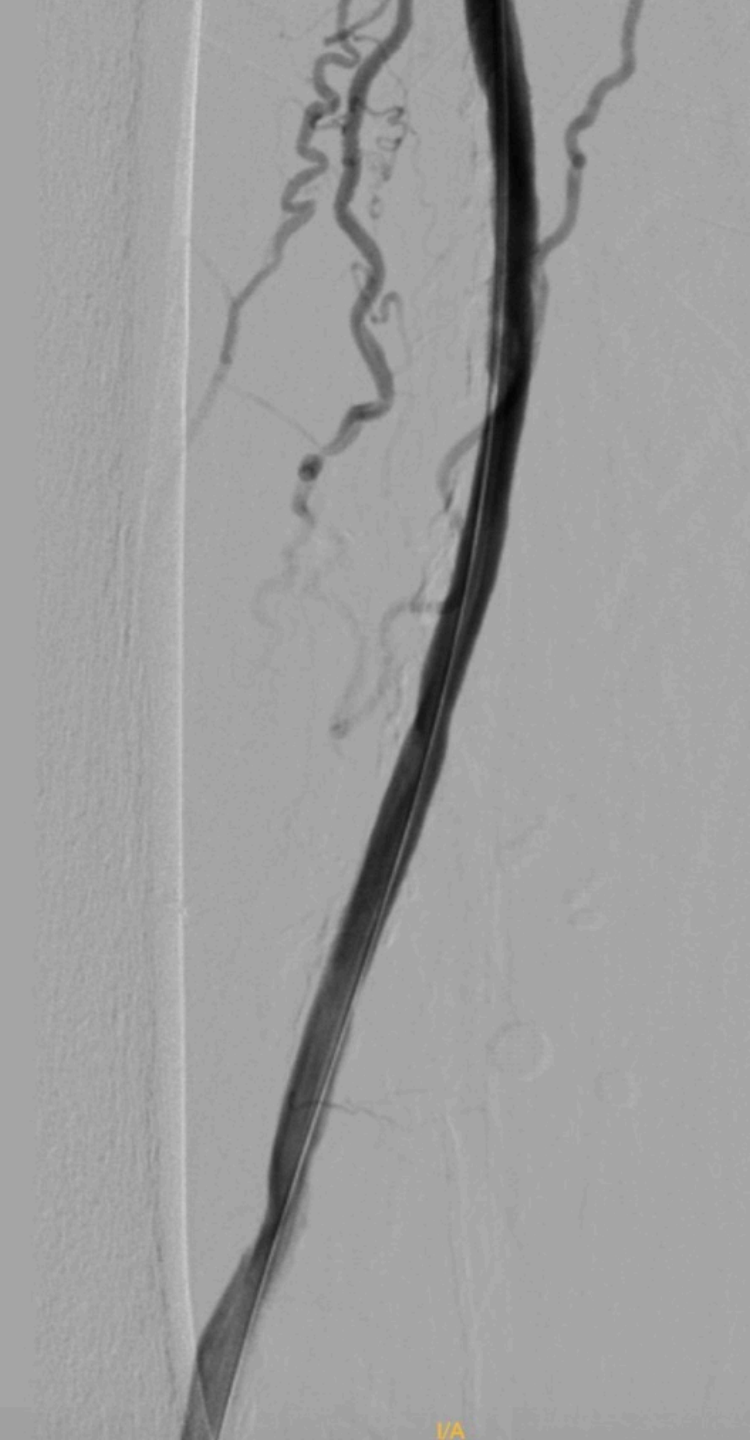
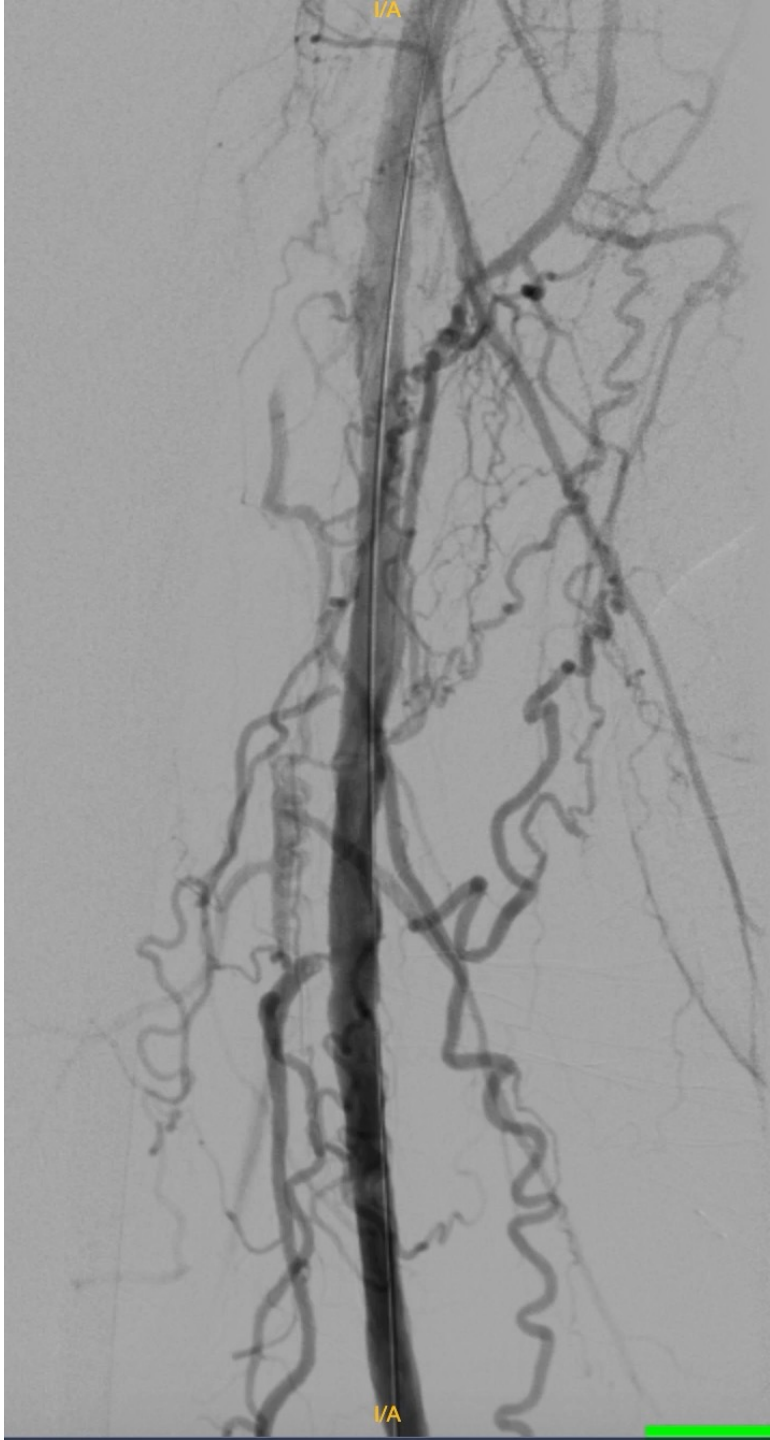
Shockwave 6.60 x 60mm  
5 ciclos 150 pulsos



BALON 6.0 X 120 mm

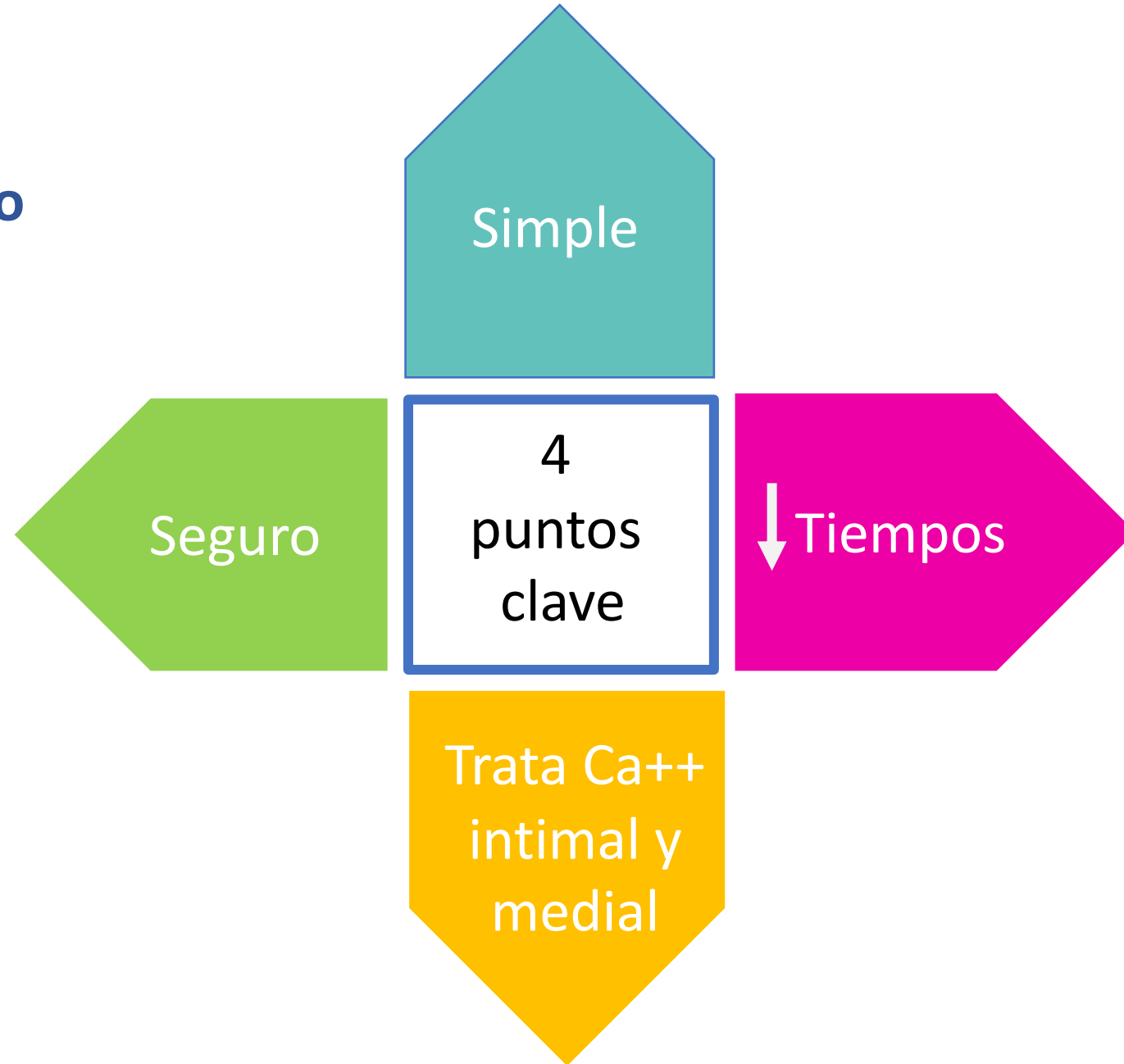
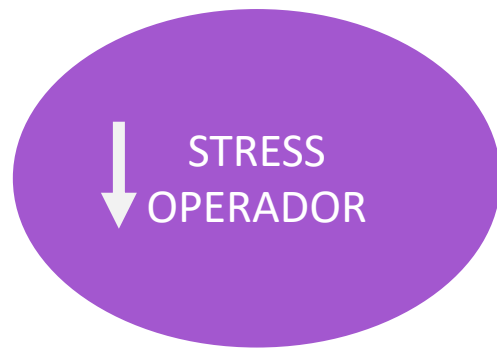


Balón con Ranger  
Paclitaxel 6.0x 150 m



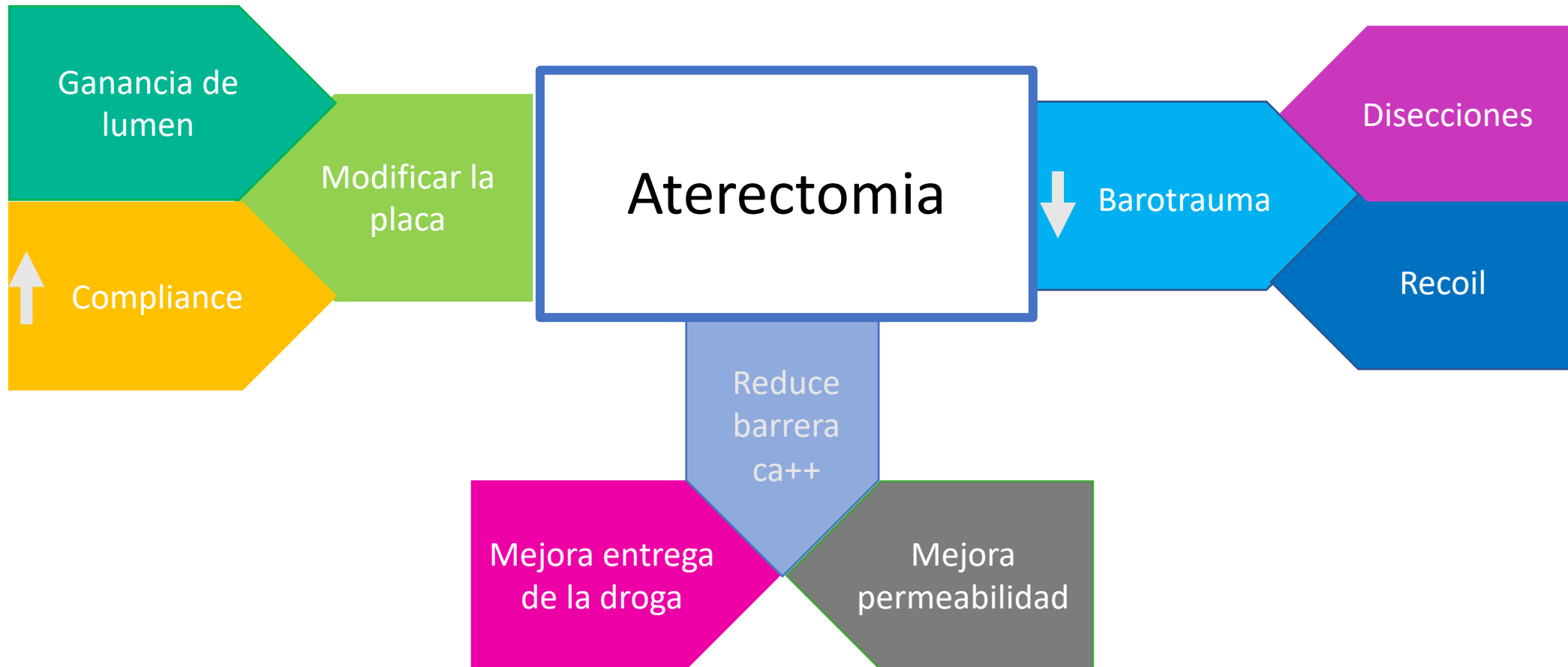
# Resumen

## Shockwave en Preparación del vaso

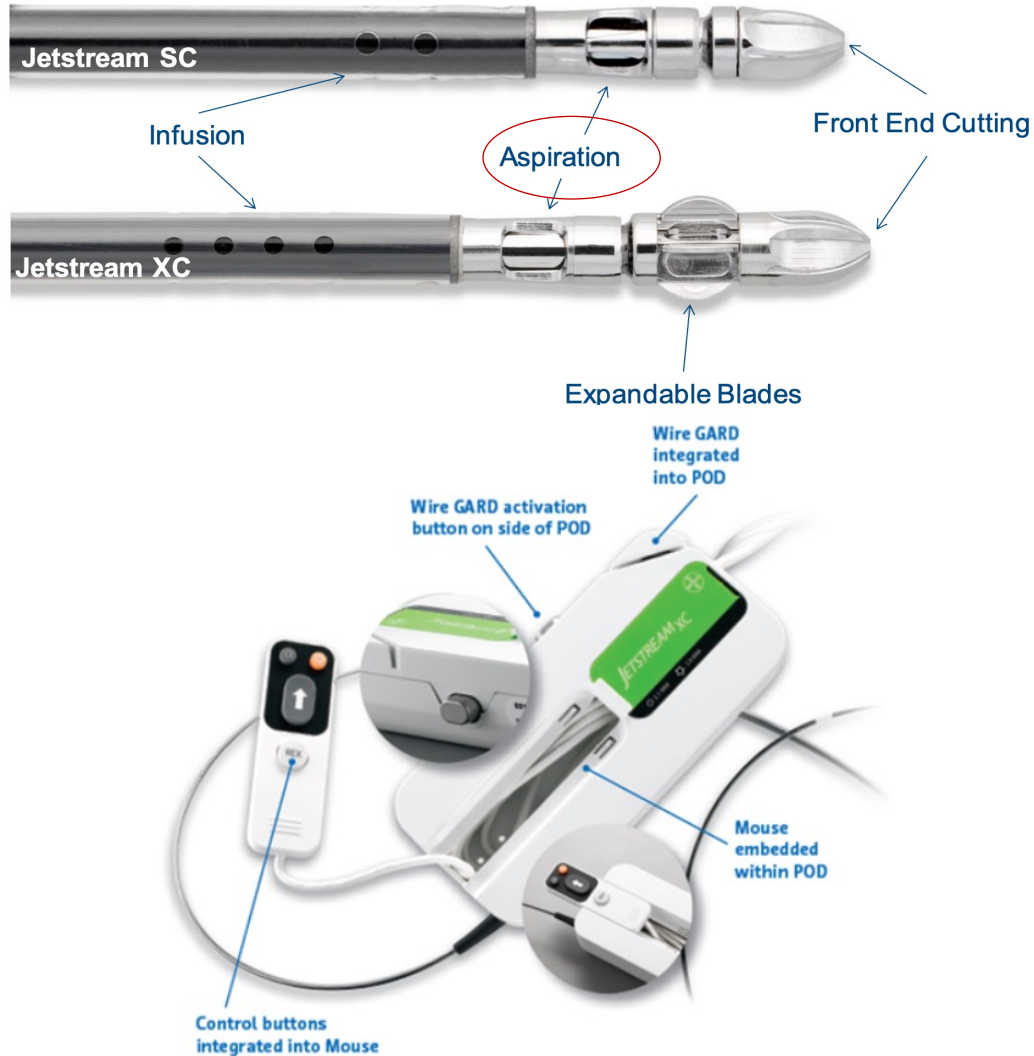


# Por qué aterectomía?

## Preparación del vaso



# Algunas características del jetstream



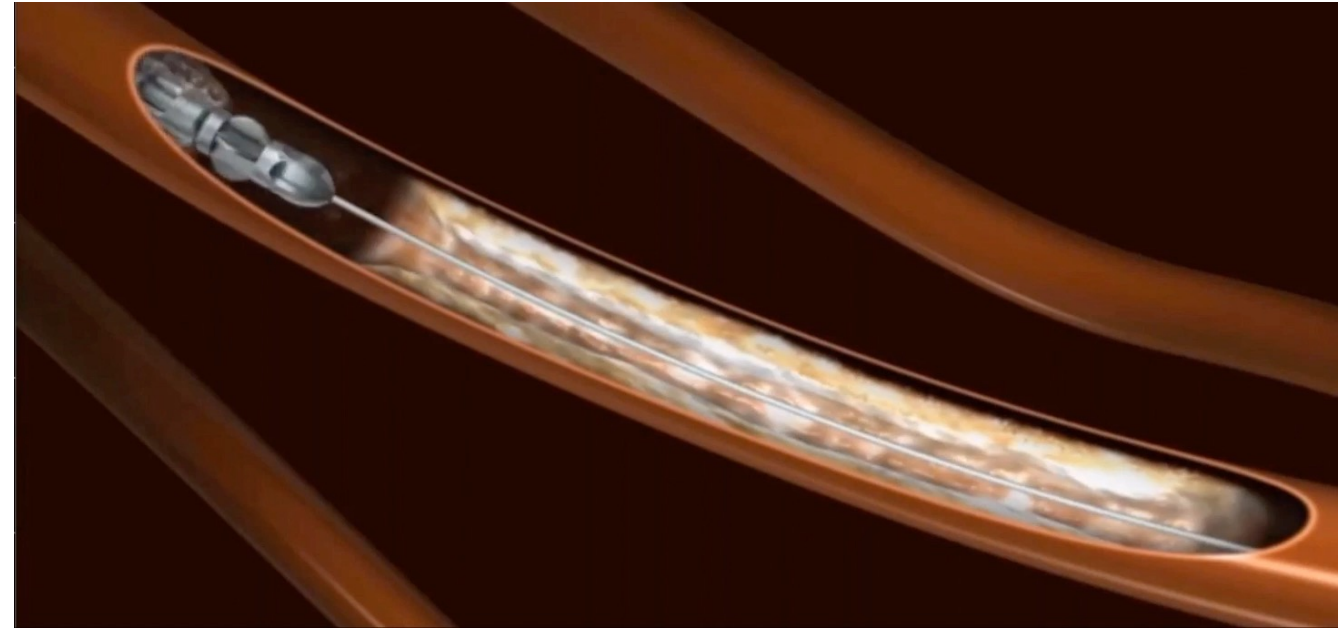
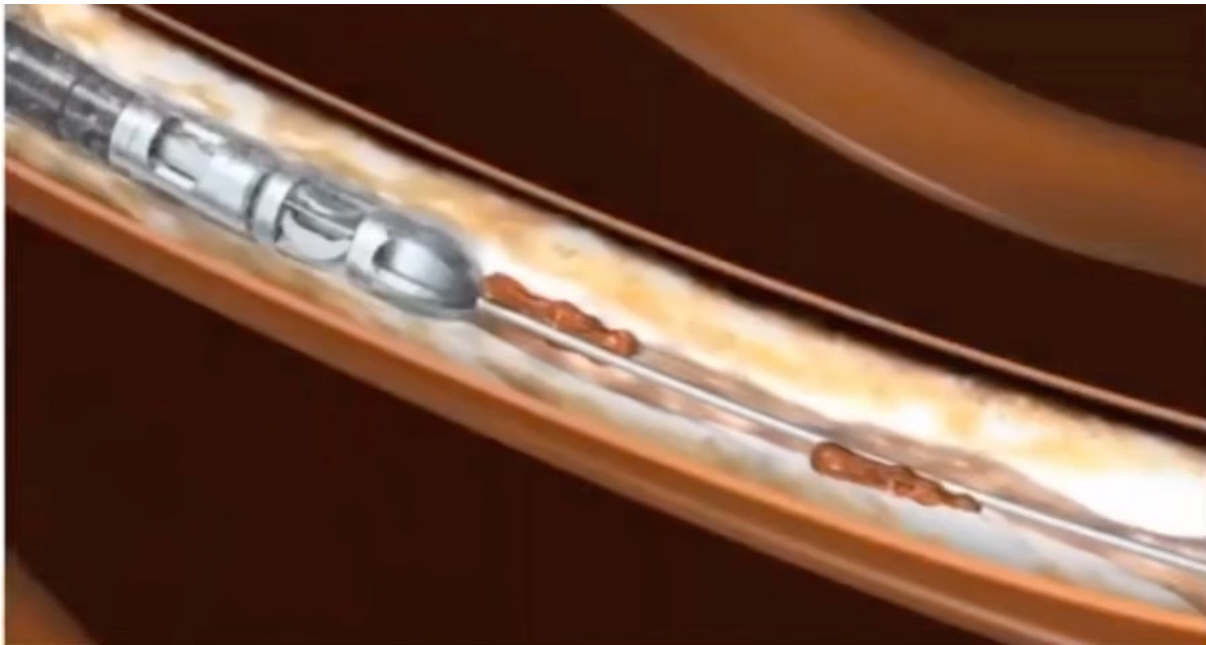
## eXpandable Cutters (XC)



## Single Cutter (SC)



# JETSTREAM

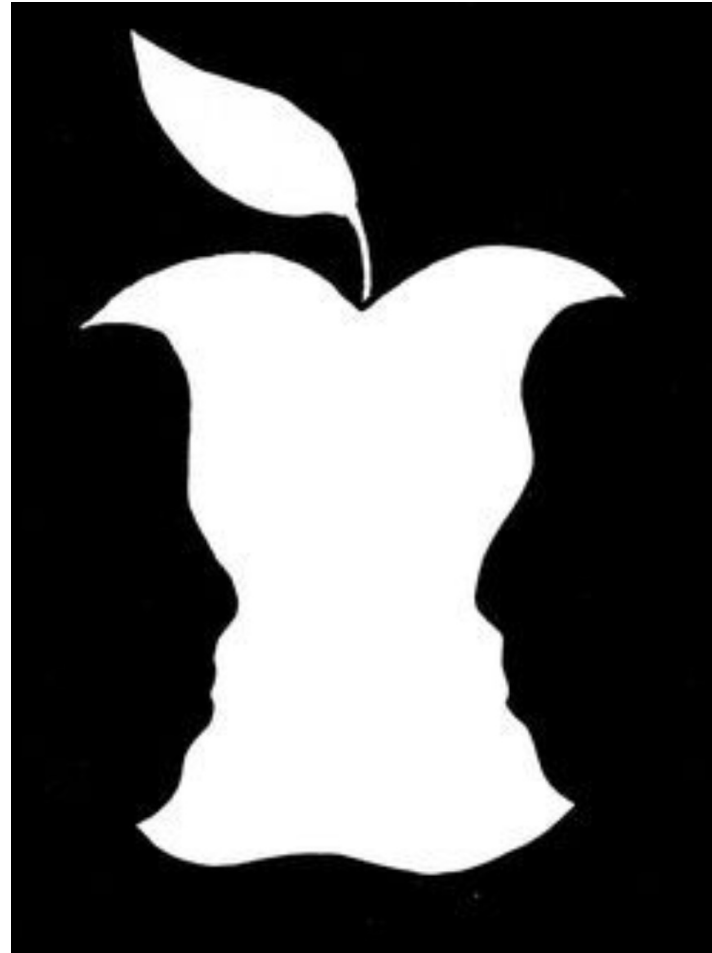


# Aterectomia + DBC

Se complementa o se necesitan

## Factores mecánicos

Recoil o disección  
Calcio una barrera para la entrega droga



SINERGICOS  $1+1 > 2$

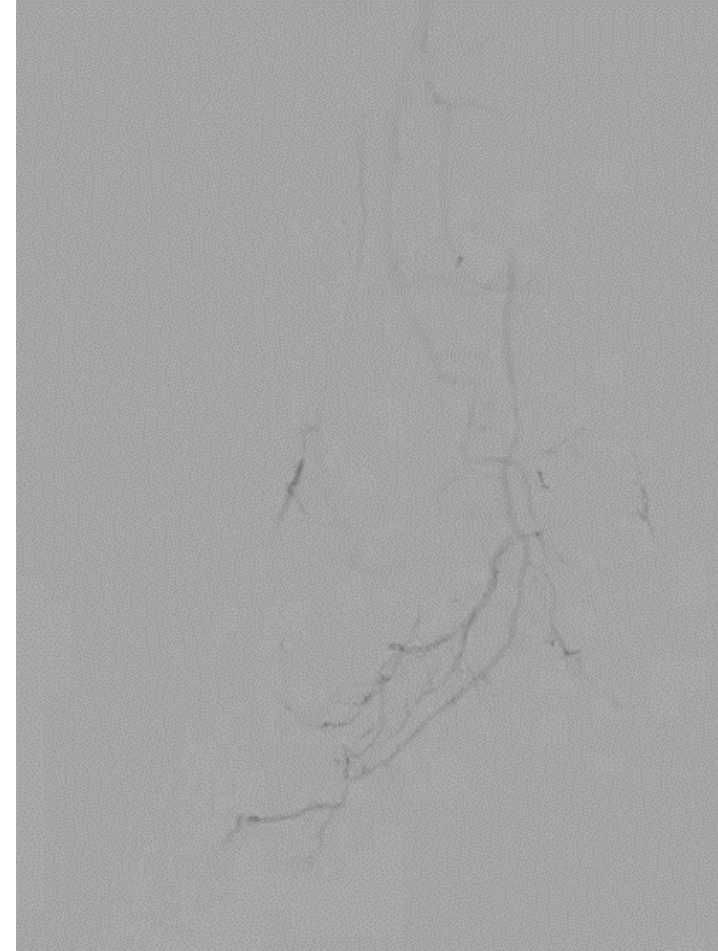
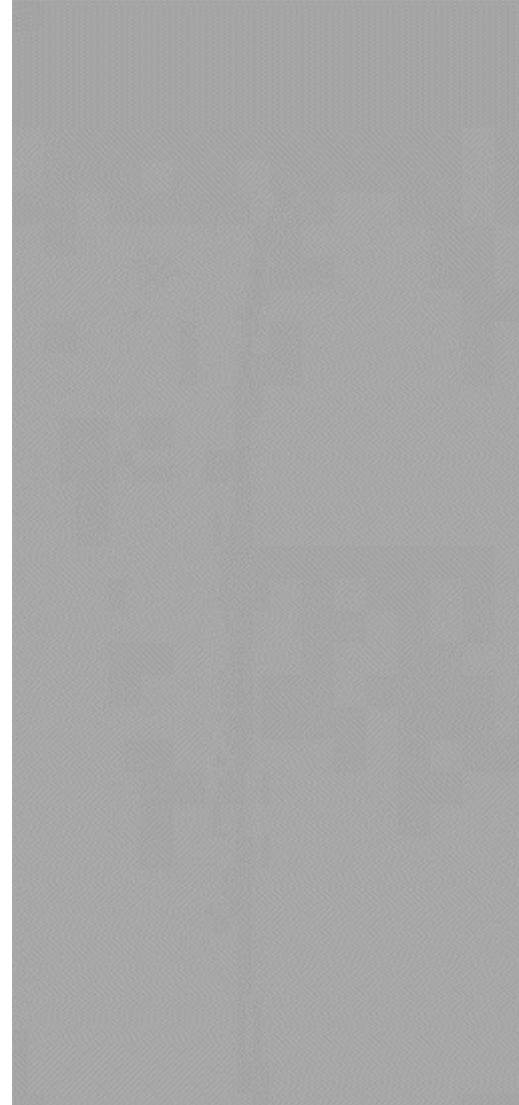
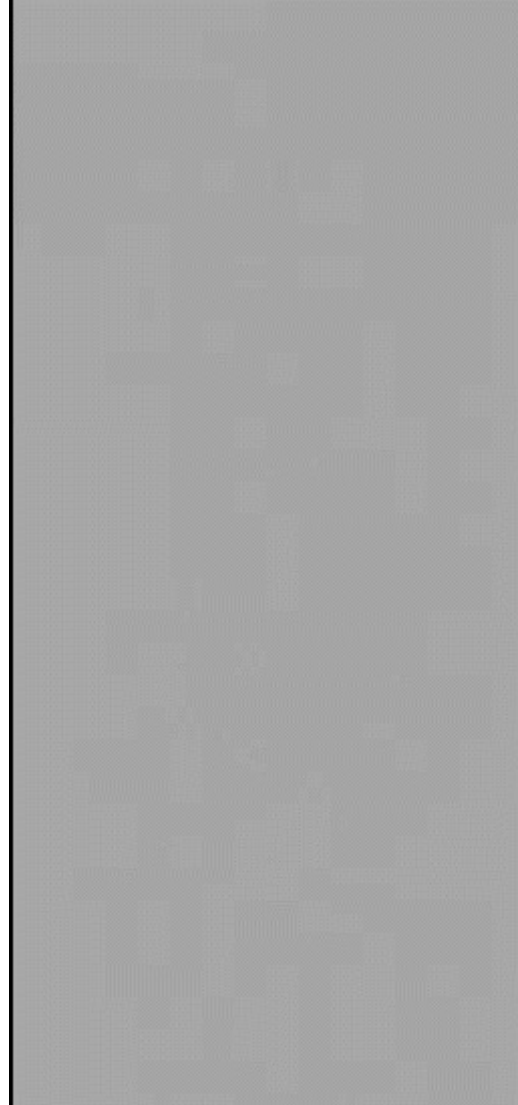
## Factores biológicos

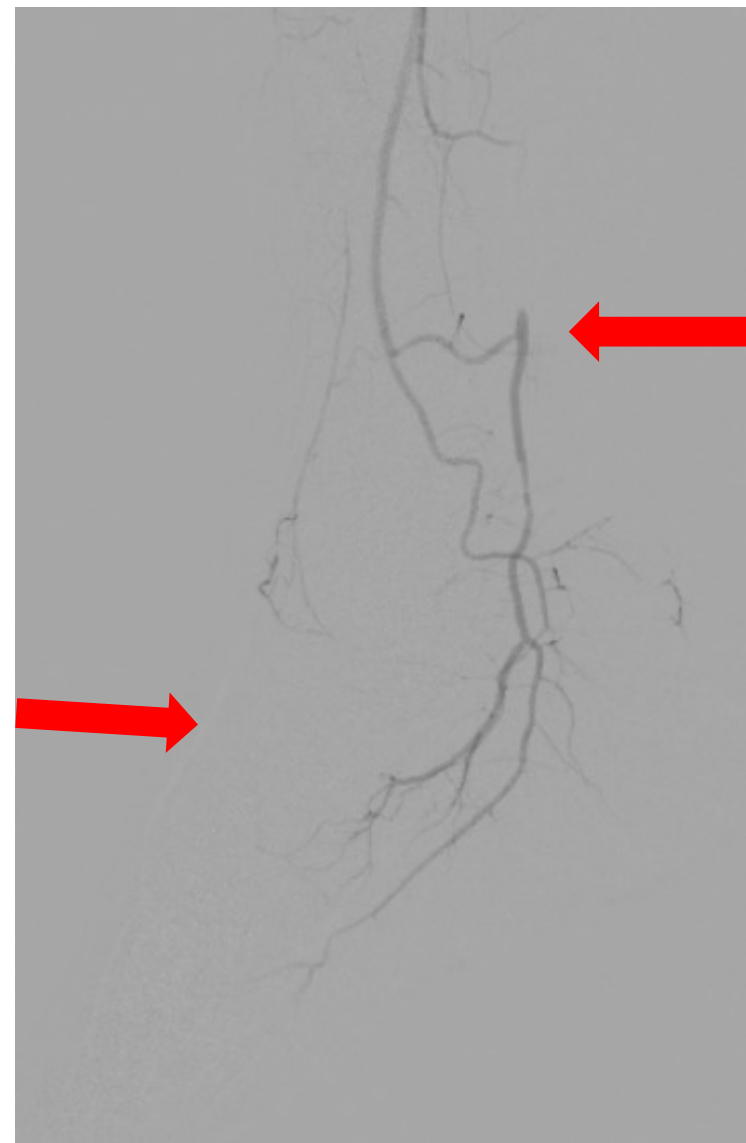
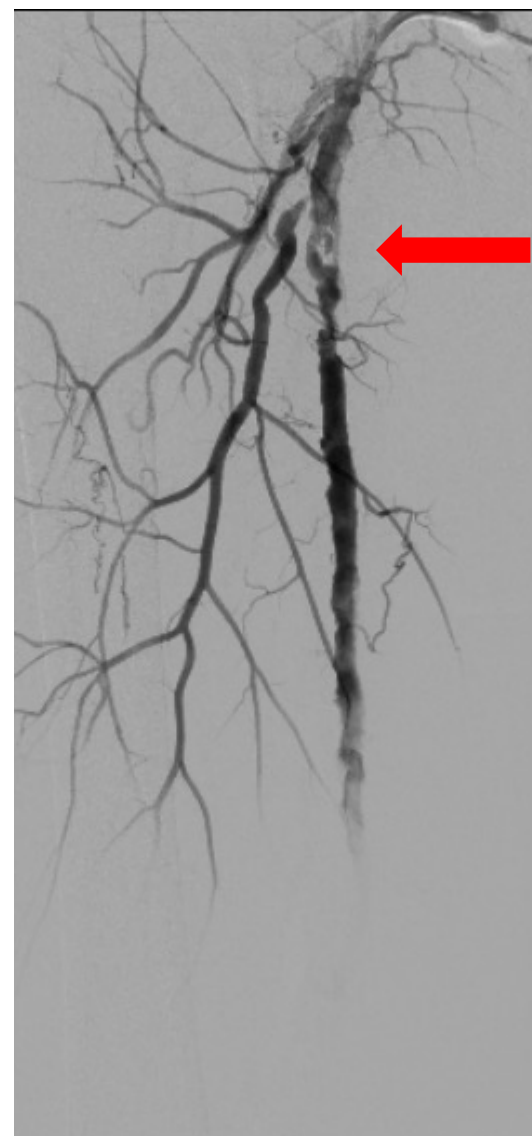
Injuria del endotelio  
Antiproliferativo  
>Permeabilidad  
<TLR





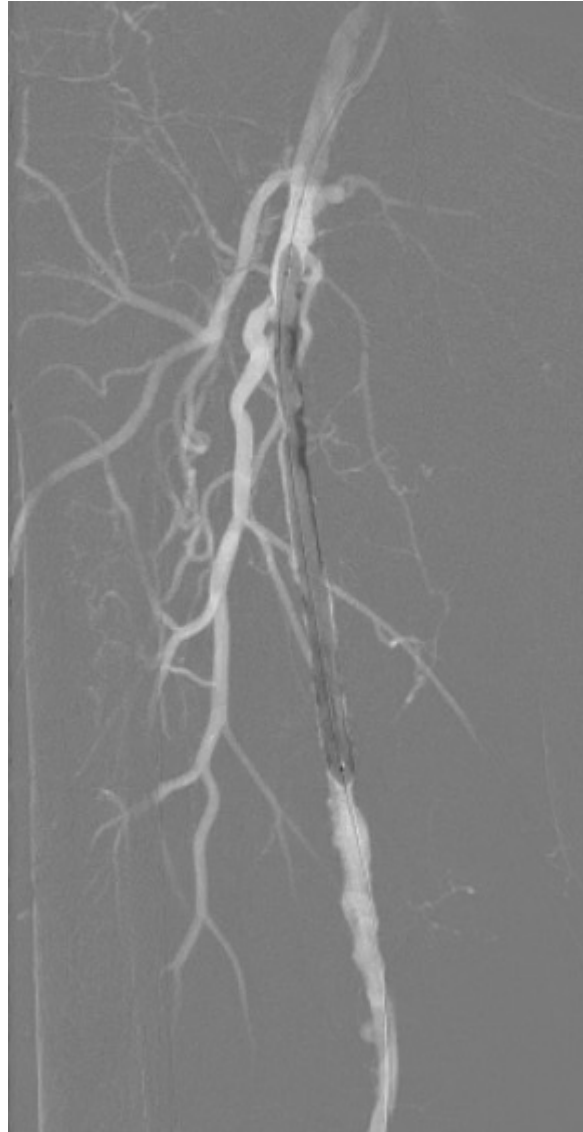
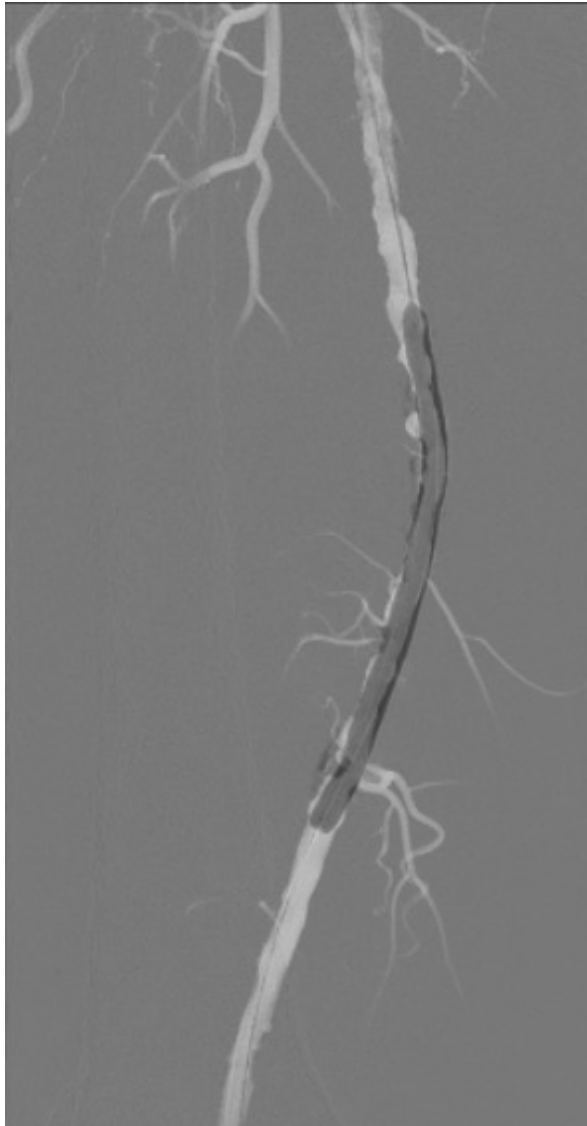
# Caso Jetsream

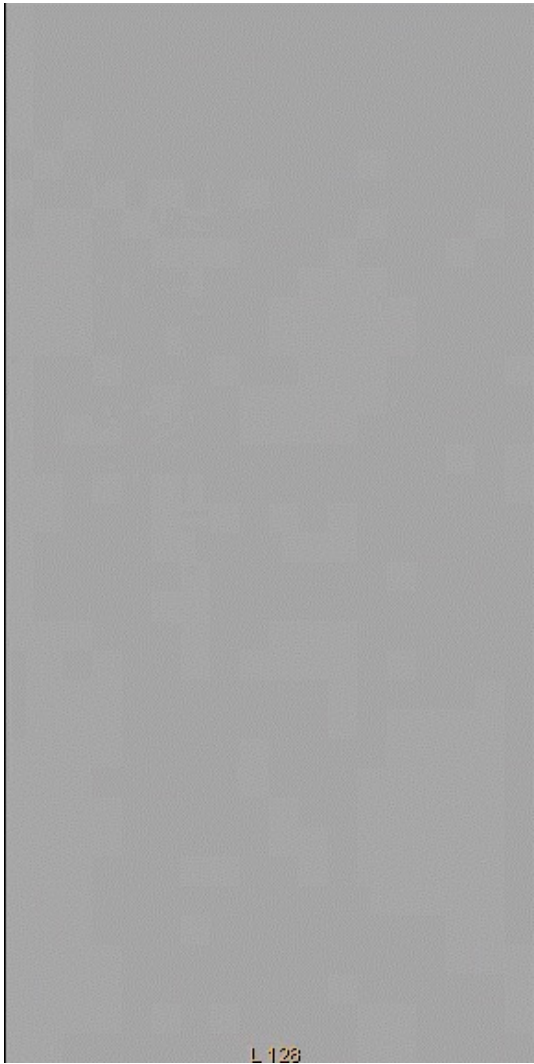




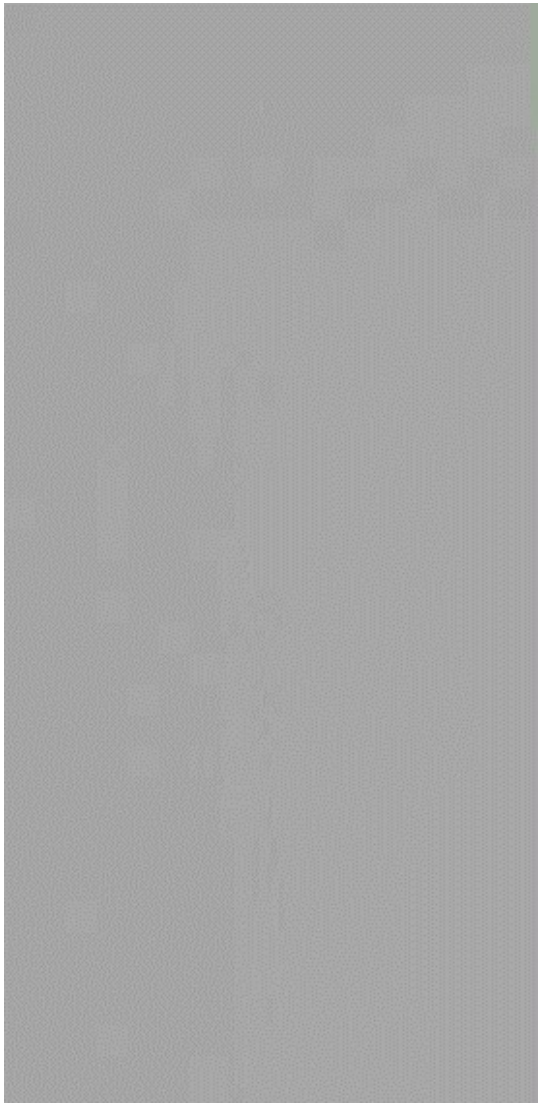
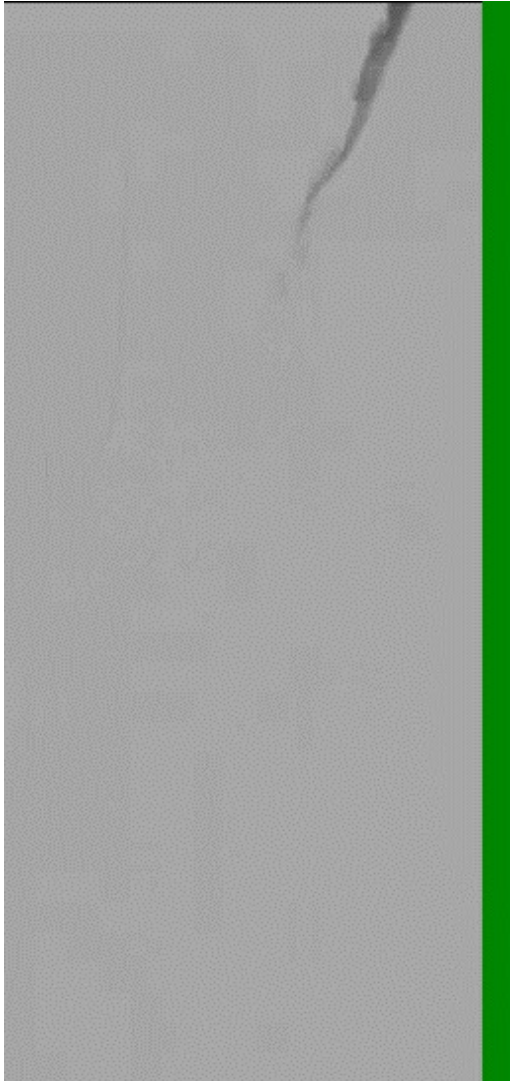


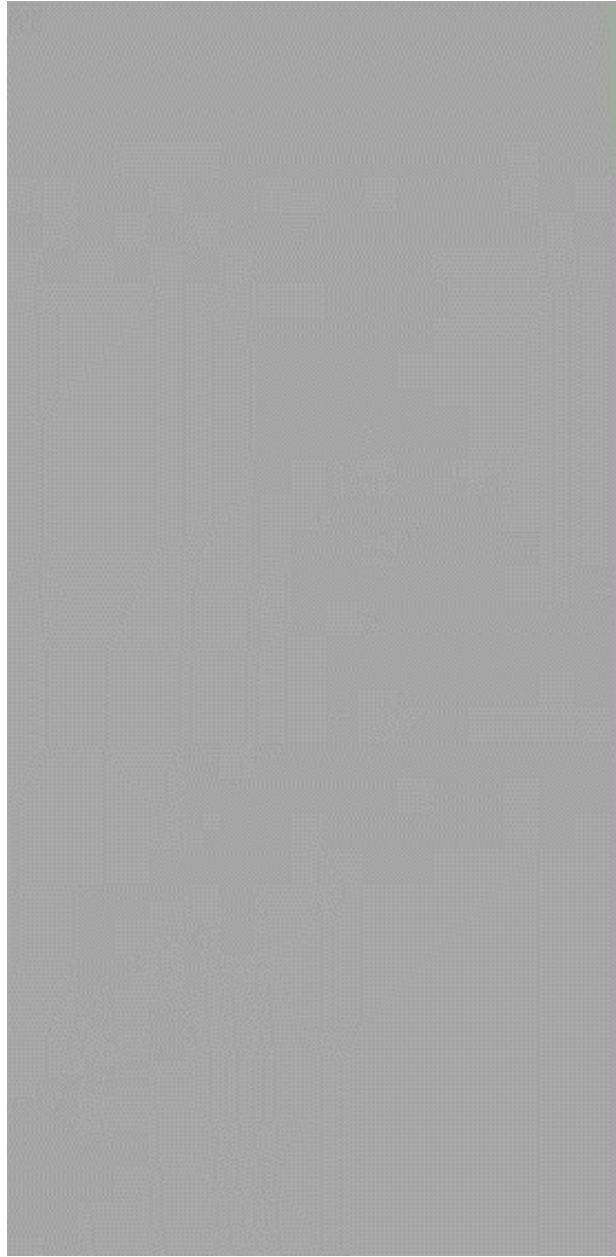
# Balones convencionales

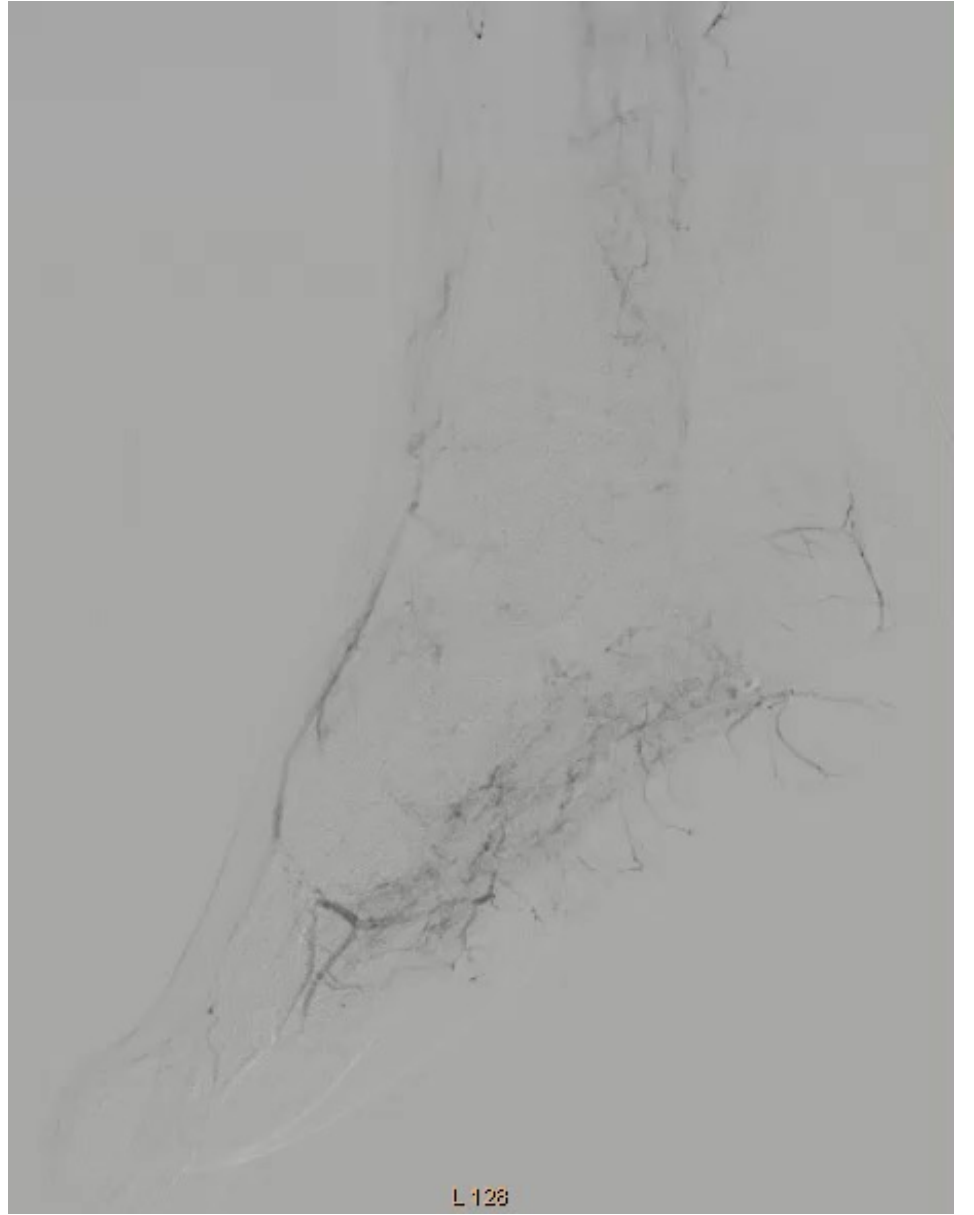




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# Evaluar dispositivo

## **ATERECTOMIA**

- ✓ Aspiracion continua
- ✓ Lesiones largas
- ✓ Lesion mixta

## **IVL**

- ✓ Circunferencia
- ✓ Run-off pobre
- ✓ Retrogrado



# Conclusiones

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- Elegir una estrategia adecuada para la preparación del vaso en calcificaciones severas.
- Optimiza la ganancia del lumen, la recuperación de la elasticidad del vaso.
- IVL/ ATERECTOMIA +DCB presenta resultados prometedores y probable reducción de reintervenciones a mediano y largo plazo.
- Reduce las complicaciones por barotrauma, embolizaciones, necesidad de stent con probables beneficios en los resultados y reducción de costos a largo plazo

# MUCHAS GRACIAS!!!!



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