



Insight about ultrasound in planing,  
access and control of BTK angioplasty.  
State of the art of BTK-CLI treatment

*Dr. E. Puras Mallagray*  
*Hospital Universitario Quirón Madrid*  
*SPAIN*

## Disclosure

Speaker name:

.....

I have the following potential conflicts of interest to report:

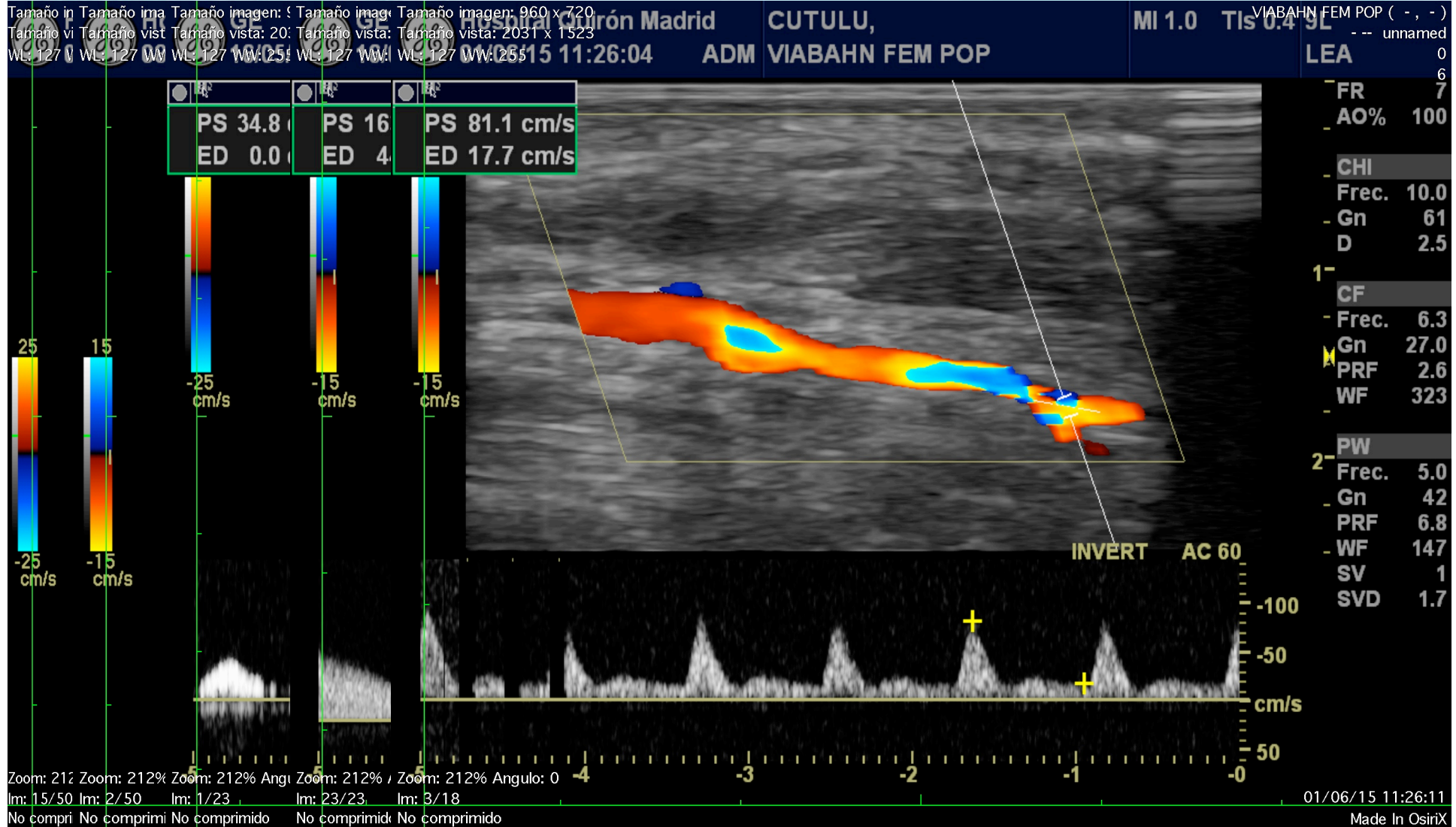
- Consulting
- Employment in industry
- Shareholder in a healthcare company
- Owner of a healthcare company
- Other(s)

**I do not have any potential conflict of interest**

+++++



# Ultrasound in planing an Endovascular infrapopliteal approach



# Insight about ultrasound in planing, access and control of BTK angioplasty.

## State of the art of BTK-CLI treatment

Tamaño imagen: 960 x 720  
Tamaño vista: 2031 x 1523  
WL: 127 WW: 255

Tamaño imagen: 960 x 720  
Tamaño vista: 2031 x 1523  
WL: 127 WW: 255

Tamaño imagen: 960 x 720  
Tamaño vista: 2031 x 1523  
WL: 127 WW: 255

MI 1.3 TIs 0.5 9L 000000001 ( -, - )  
ADM LEA 0

The high-resolution images and accurate hemodynamic information provided by modern duplex scanners makes them a reliable tool for preoperative, intraoperative and postoperative surveillance of infrainguinal endovascular treatments

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61  
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2.5  
84

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No comprimido

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# Arterial Eco-Doppler vs Arteriography INFRAPOPLÍTEAL SECTOR

## Karacagil

- 480 segments in 40 extremities Diagnostic in 97% of the cases
- False positive 44 (occluded in the echo-Doppler, Arteriography in permeable) - 21 correspond to Peroneal artery

## Koelemay

- non diagnostic studies: 0' 7% with Eco-Doppler, 6' 2% with Arteriography. 12% in both in the foot.
- Global Kappa 0'47 - varies between 0'11 in distal Peroneal and 0'75 in Tibialis anterior proximal. Worse results in TTP and distal Peroneal with both tests



# Arterial Eco-Doppler vs Arteriography INFRAPOPLÍTEAL SECTOR

## Similar Results

<b>AUTOR</b>	<b>S (%)</b>	<b>E (%)</b>	<b>VPP (%)</b>	<b>VPN (%)</b>	<b>KAPPA (I.C.)</b>
ZEUCHNER <sup>137</sup>	96'4	92'3	98'8	80	96% (fiabilidad)
KARACAGIL 1996 " <sup>140</sup>	76-80	58-87	71-80	74-89	0'57-0'64 (NA)
SENSIER 1998 B <sup>173</sup>	21	98			0'5 (0'39-0'61)
SENSIER 1998 B* <sup>173</sup>	70	91			0'63 (0'50-0'74)
KOELEMAY1998" <sup>160</sup>	53-72	80-95	75-90	55-76	0'51 (0'48-0'55)
ALY 1999 <sup>135</sup>	82	99	82	100	0'81 (0'75-0'87)
<i>ESTUDIO ACTUAL</i>	65	80'6	77'1	69'7	0'46 (0'42-0'49)
<i>ESTUDIO ACTUAL*</i>	58'4	86'3	73'1	76'5	0'46 (0'43-0'50)

# Arterial Eco-Doppler vs Arteriography

## INFRAPOPLÍTEAL SECTOR

- Duplex Ultrasound Arterial Mapping (DUAM), permits the design of medical, surgical, or endovascular treatment plans with a high level of concurrence with the findings acquired during the revascularization procedure.
- The DUAM can be used as the sole preoperative mapping modality in a proper vascular laboratory setup, where doctors have direct access to the operating room, where they can compare their findings with the intraoperative lesions and improve their understanding of the procedure performed.

# A 3-D ULTRASOUND IMAGING ROBOTIC SYSTEM TO DETECT AND QUANTIFY LOWER LIMB ARTERIAL STENOSES: *IN VIVO* FEASIBILITY

MARIE-ANGE JANVIER,<sup>\*†</sup> SAMIR MEROUCHE,<sup>\*†</sup> LOUISE ALLARD,<sup>\*</sup> GILLES SOULEZ,<sup>†§</sup>  
and GUY CLOUTIER<sup>\*†§</sup>



Where the US probe  
is attached to the  
robotic arm

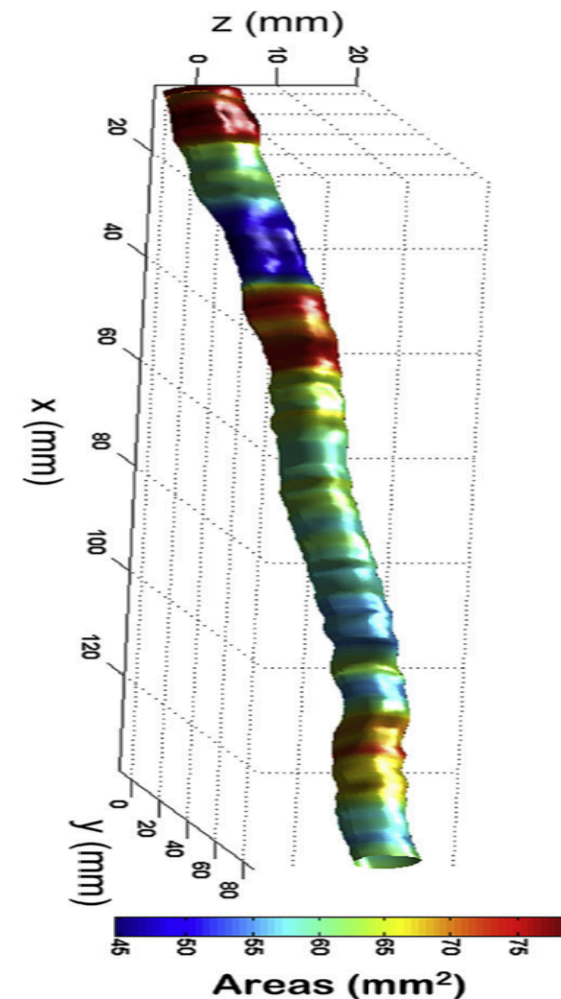


Fig. 1. F3 CRS robotic arm used in the 3-D ultrasound (US) imaging robotic system.



# Access of BTK angioplasty: Probe preparation

**MEET** 2015  
MULTIDISCIPLINARY EUROPEAN  
ENDOVASCULAR THERAPY

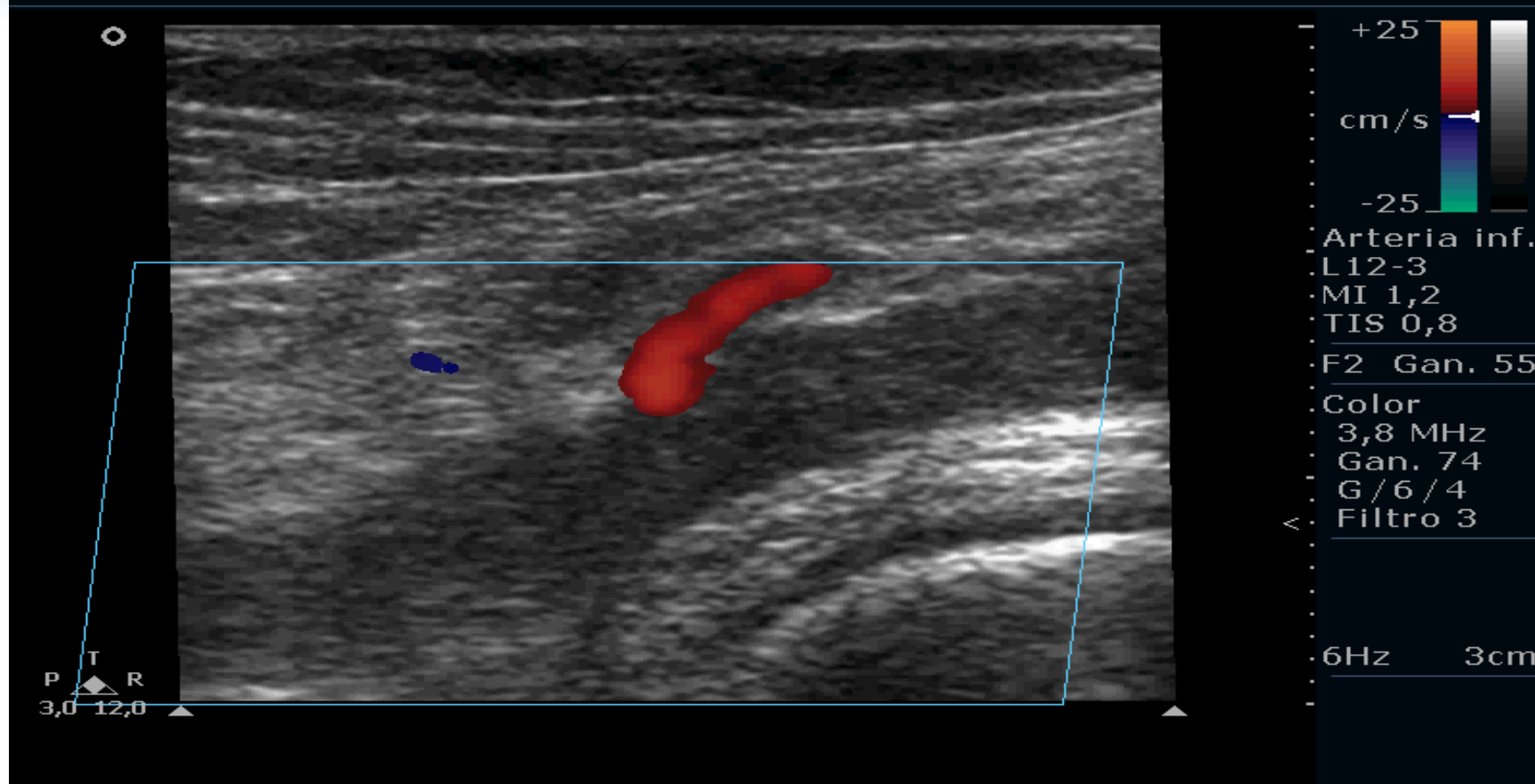


# US: Popliteal embolic diagnosis

juan he,  
06-04-19-094055

HOS. FUND. ALCORCON

19/04/2006 PHILIPS  
9:51:09

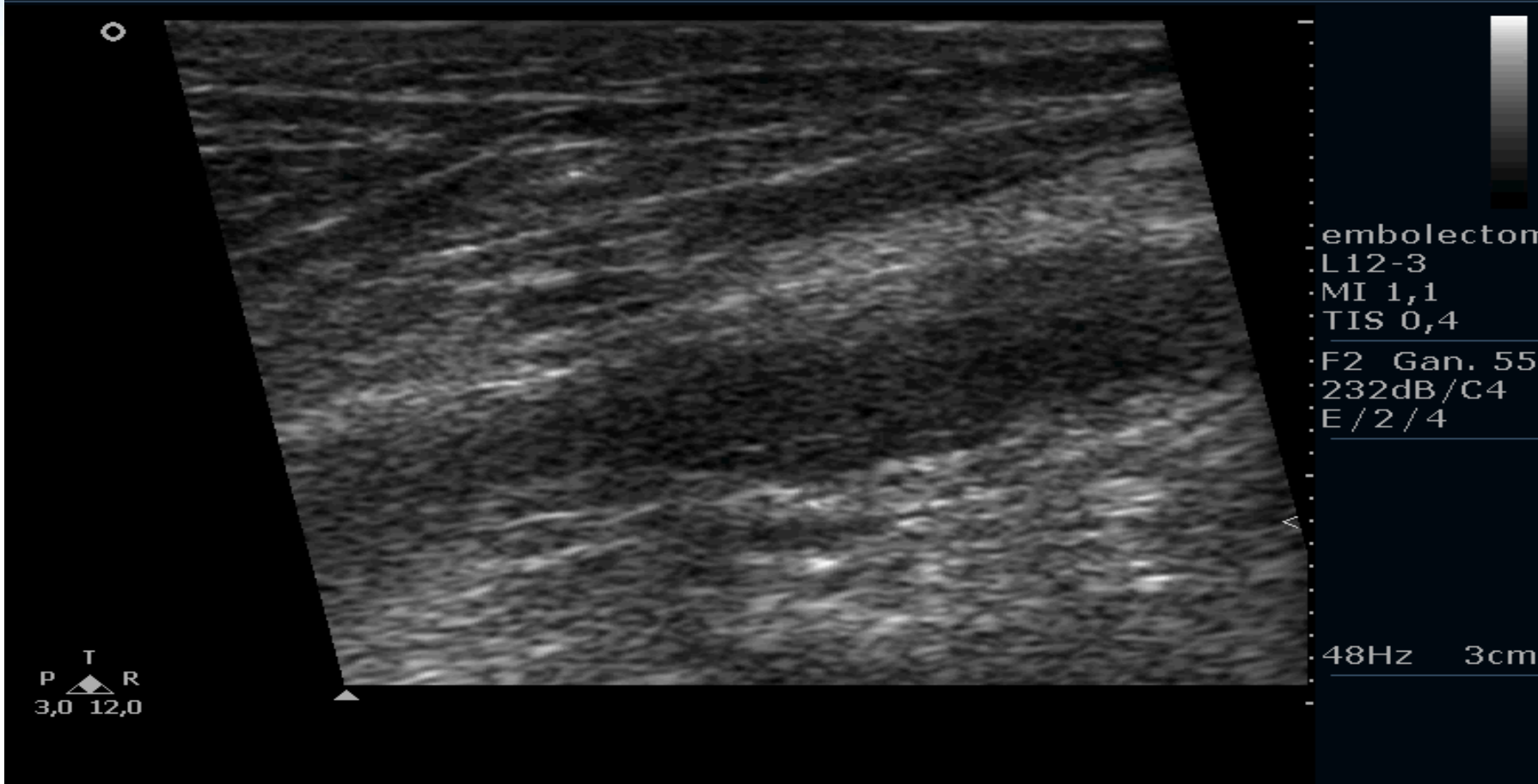


# Ecoguided Embolectomy

zarza, embolia  
06-02-16-133320

HOS. FUND. ALCORCON

16/02/2006 **PHILIPS**  
14:26:49





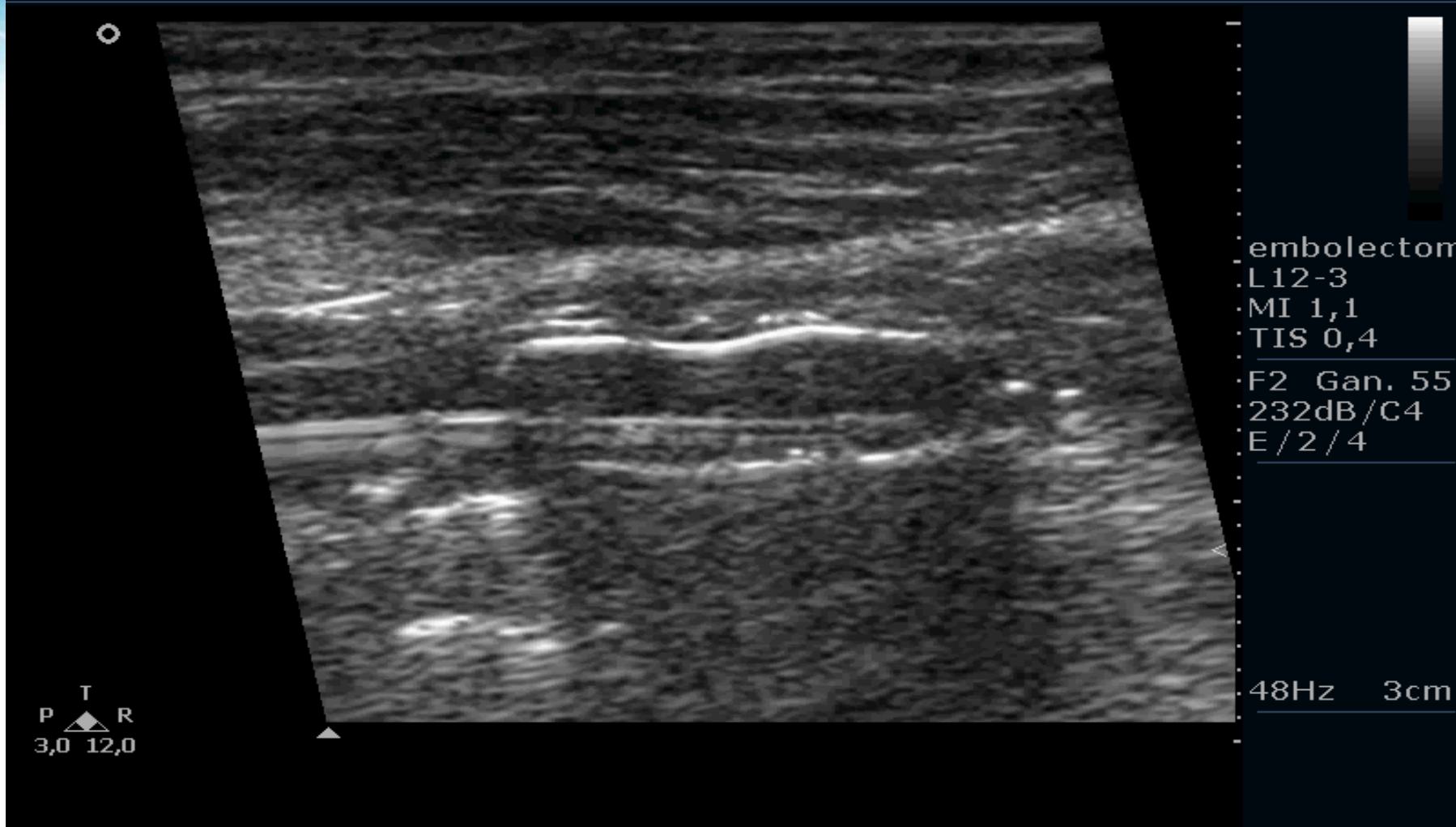
# Ecoguided Embolectomy

**MEET** 2015  
MULTIDISCIPLINARY EUROPEAN  
ENDOVASCULAR THERAPY

zarza, embolia  
06-02-16-133320

HOS. FUND. ALCORCON

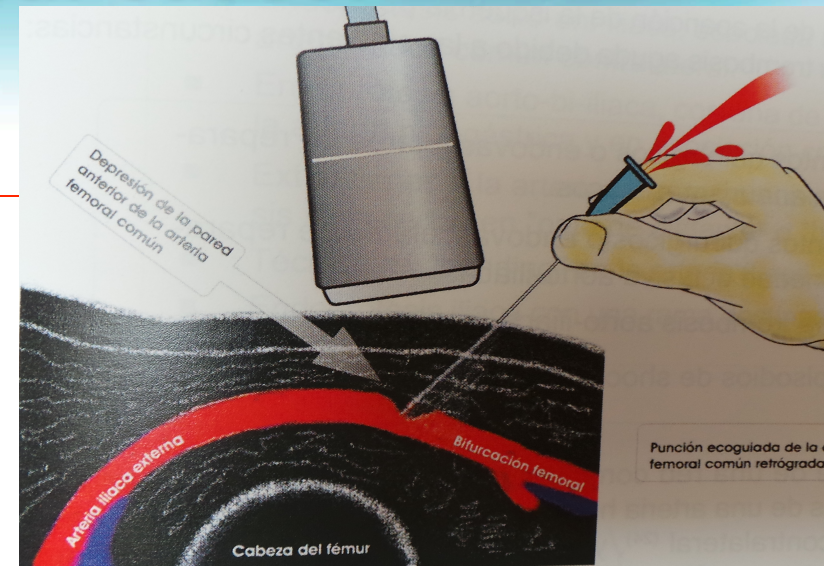
16/02/2006 **PHILIPS**  
14:27:50



# US in Endovascular access infrapopliteal arterial cases:

MEET 2015  
MULTIDISCIPLINARY EUROPEAN  
ENDOVASCULAR THERAPY

- Antegrade common femoral
- Retrograde common femoral
- Superficial femoral/ Popliteal artery access
- Pedal or distal tibial ( PT and AT) artery access
- Evaluation of lumens/guidewire control
- Evaluation of hemodynamic results

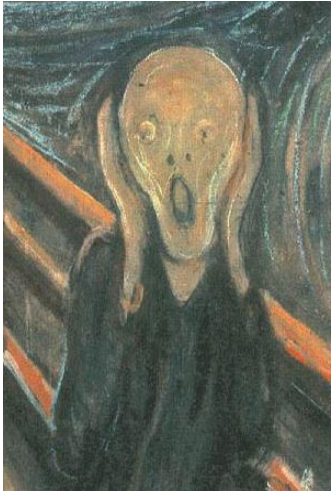


# Rationale

## Puncture Ultrasound Guidance

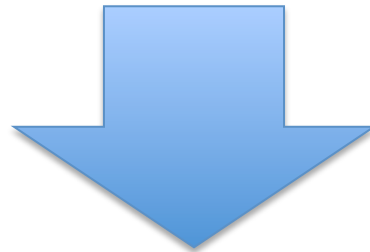
- Reduce access site complications
  - Lower risk of hematoma, bleeding, AV fistula
  - Single puncture, first pass, single wall
  - Avoid-branches, calcified plaques, previous surgical access.....
- • Optimal use of closure
  - – Avoid arterial access site disease
  - – Best choice of US guided closure techniques





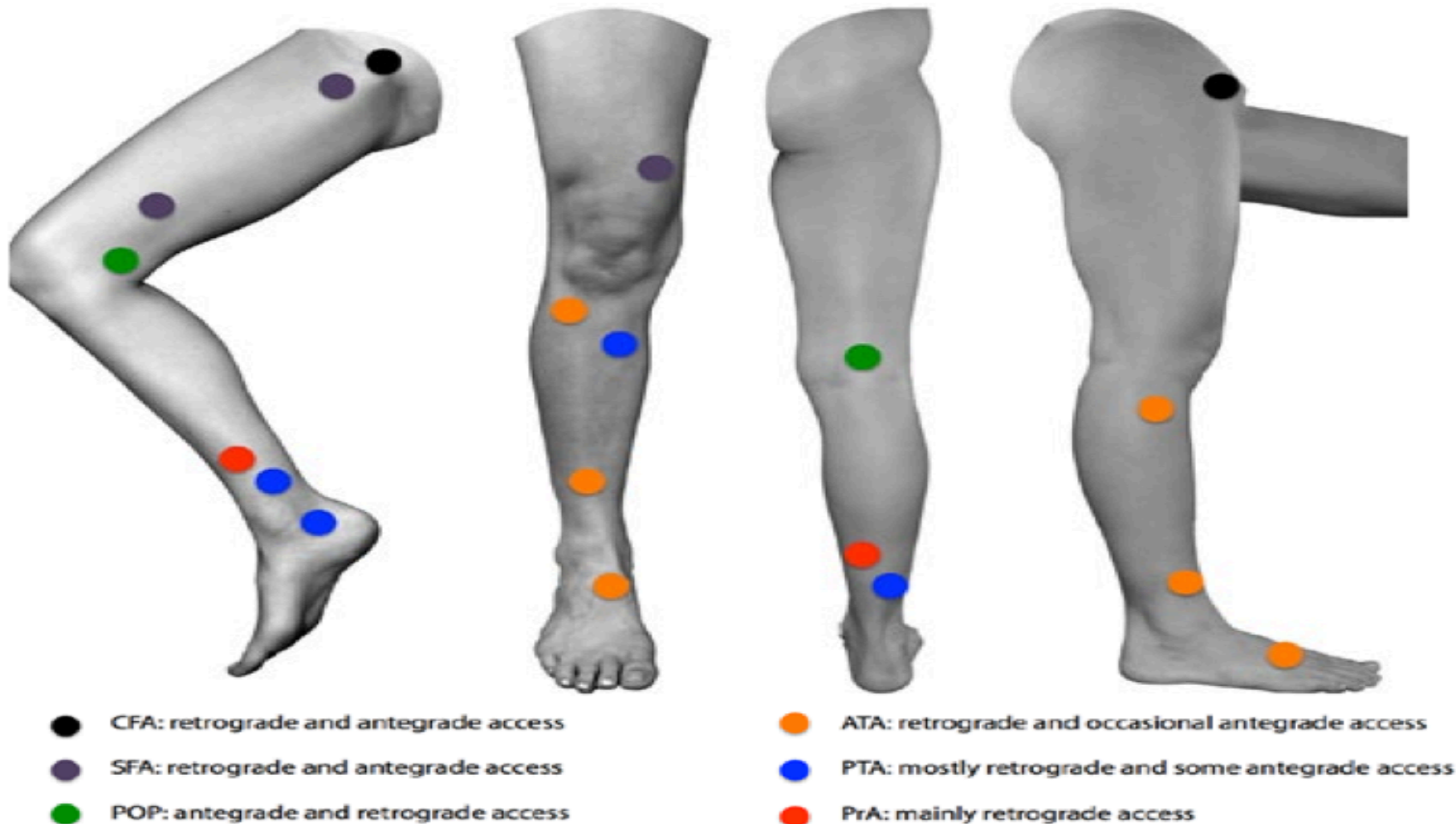
## What should we do if our initial strategy in BTK PTA fails?

1. Unable to cross the lesion....What options do I have? Other GW?  
Other devices..... **US guided retrograde access**
2. Recoil, Dissection.....Re- angioplasty??. **US hemodynamics**
3. Rupture, AVF,?.....**US diagnosis**



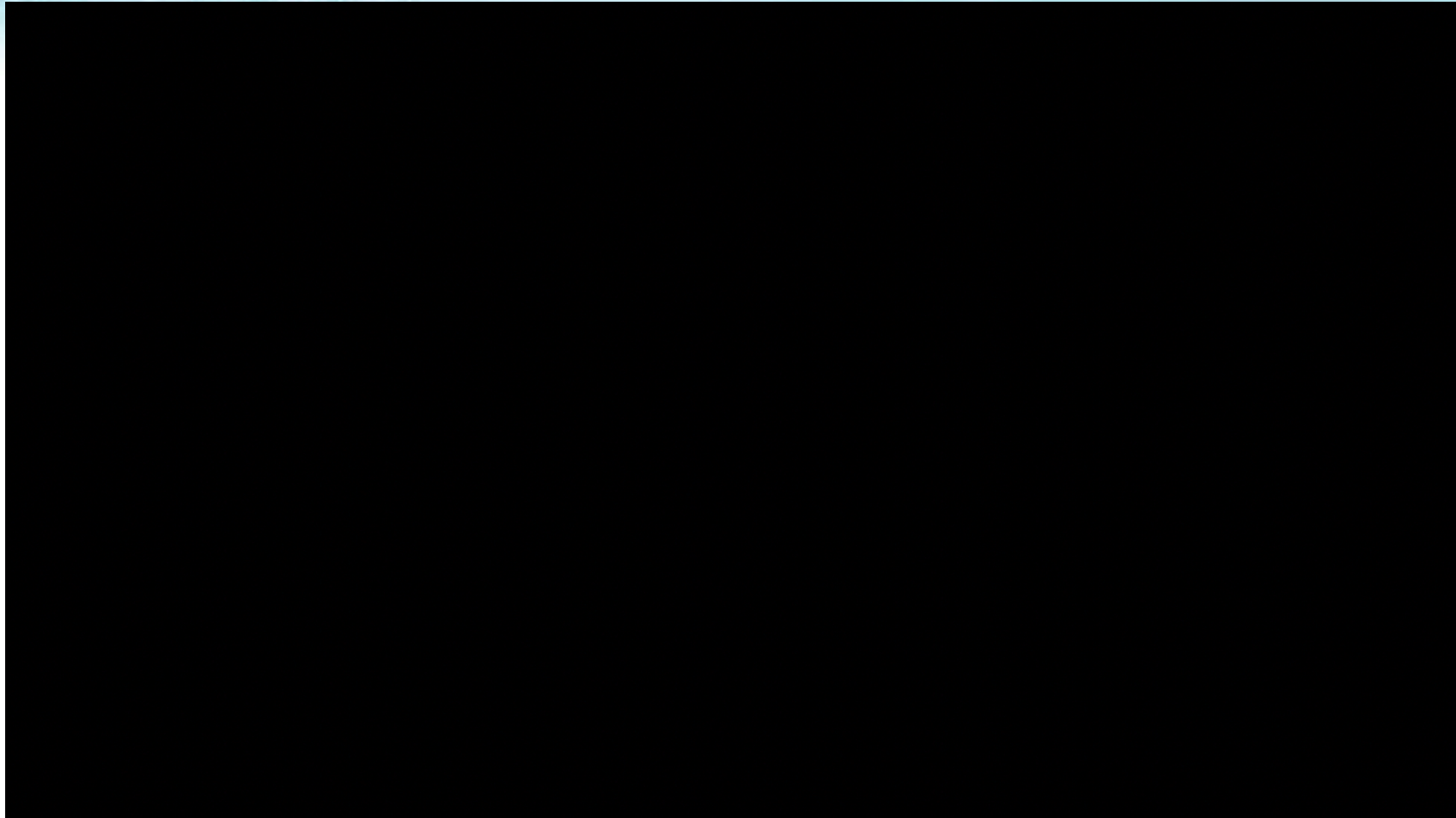
**Appropriate technical endpoint for BTK intervention  
has remained unclear...but US helps!!!!**

# Common alternative access points in patients with advanced lower extremity PAD and/or CLI.



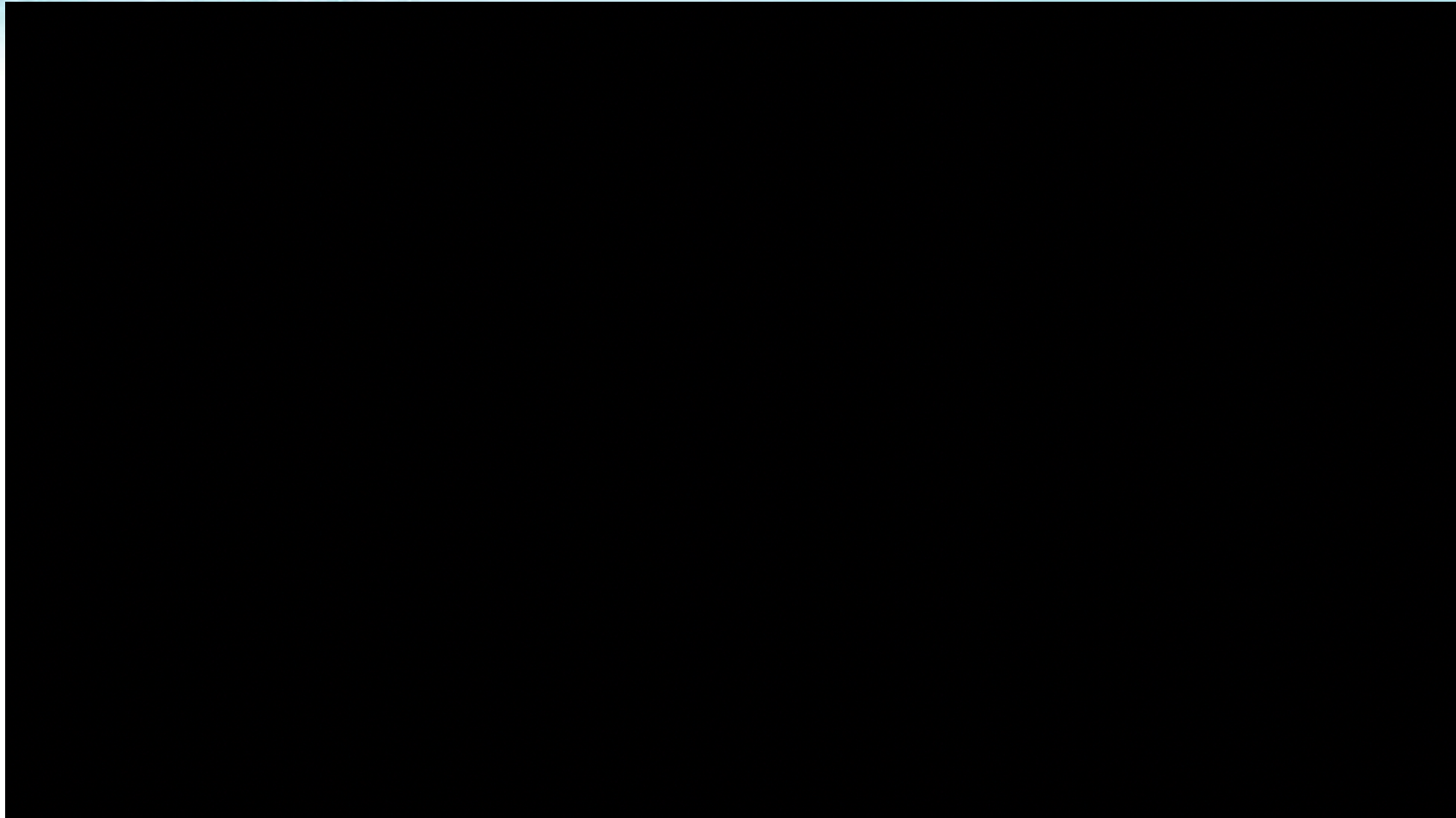
In our opinion, the use of duplex-guided access is the most feasible technique for accessing the pedal/tibial vessels

Case of lower limb endovascular  
revascularization. US in the OR.



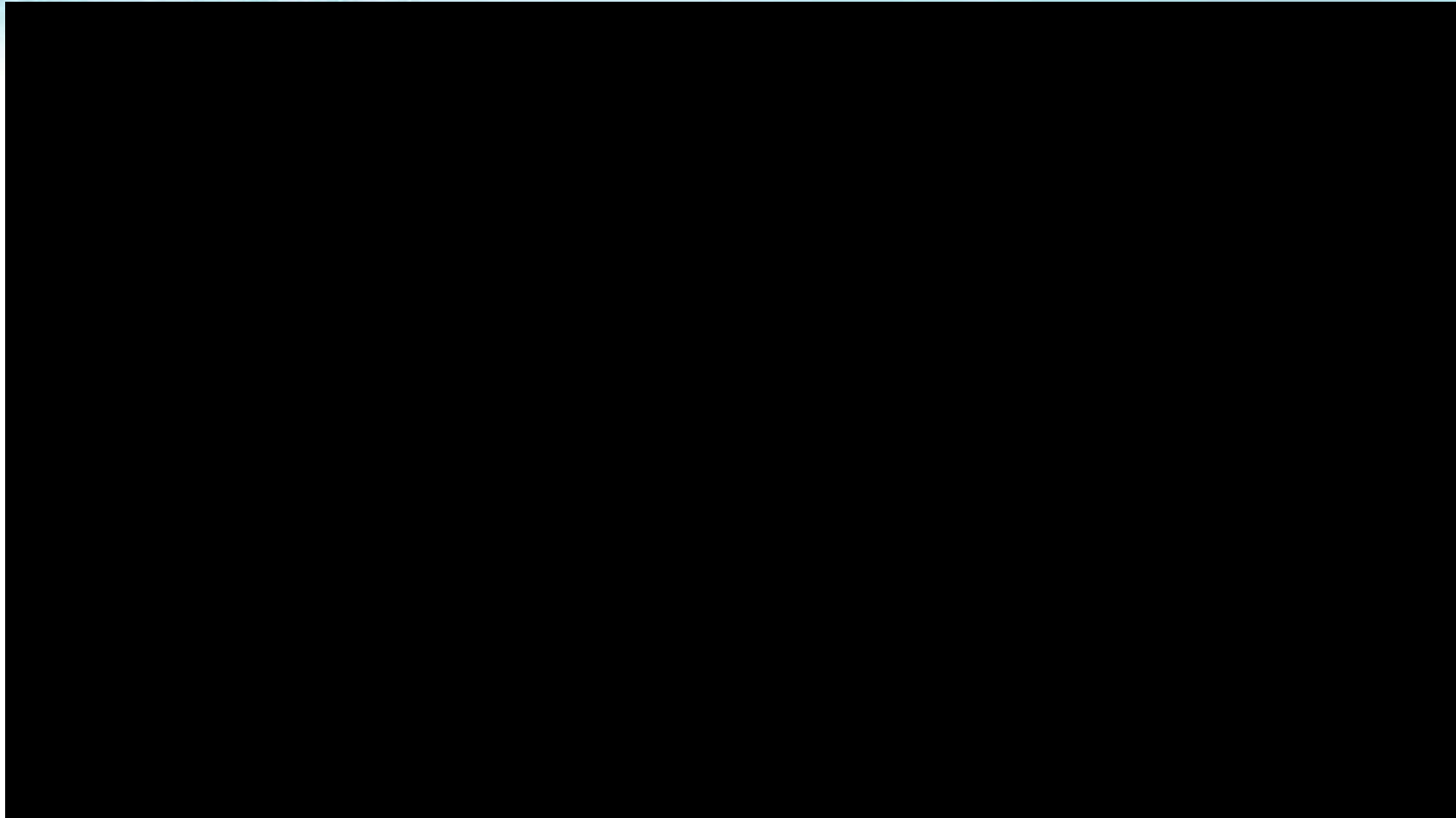


Case of lower limb endovascular  
revascularization. US in the OR.



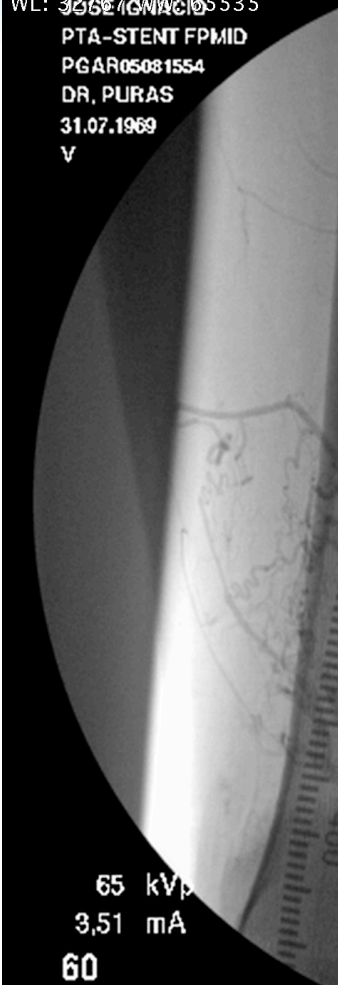


Case of lower limb endovascular  
revascularization. US in the OR.



Tamaño imagen: 512 x 512  
Tamaño vista: 1516 x 1516  
GARCIA FERNANDEZ  
WL: 327670MW/05535

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DR, PURAS  
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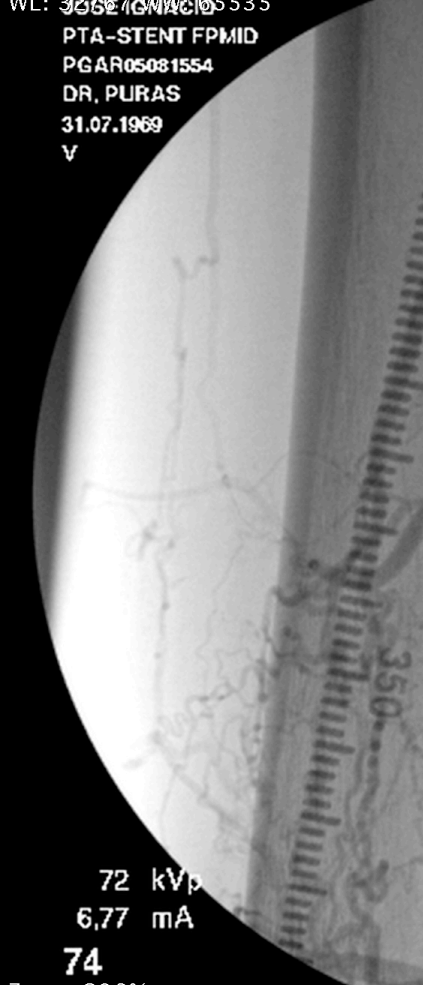
65 kVp  
3,51 mA

60

Zoom: 296%  
Im: 27/74  
No comprimido

Tamaño imagen: 512 x 512  
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GARCIA FERNANDEZ  
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DR, PURAS  
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72 kVp  
6,77 mA

74

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Tamaño imagen: 512 x 512  
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GARCIA FERNANDEZ  
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72 kVp  
6,77 mA

70

Zoom: 296%  
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Garcia Fernandez Jose Ignacio PGAR05081554 ( 45 y , 45 y )

HOSPITAL QUIRON SAADRI

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OEC 8/5/15 16:20:08

Made In OsiriX

Tamaño imagen: 960 x 720  
 Tamaño vista: 2031 x 1523  
 WL: 127 WW: 255

MI 1.3 TIs 0.5 9L  
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Zoom: 212% Angulo: 0 Im: 27/50 Zoom: 212% Angulo: 0  
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Tamaño imagen: 512 x 512  
Tamaño vista: 1516 x 1516  
CAMA: FERNANDEZ  
WL: 32767 WW: 65535

PTA-STENT FPMID  
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DR, PURAS  
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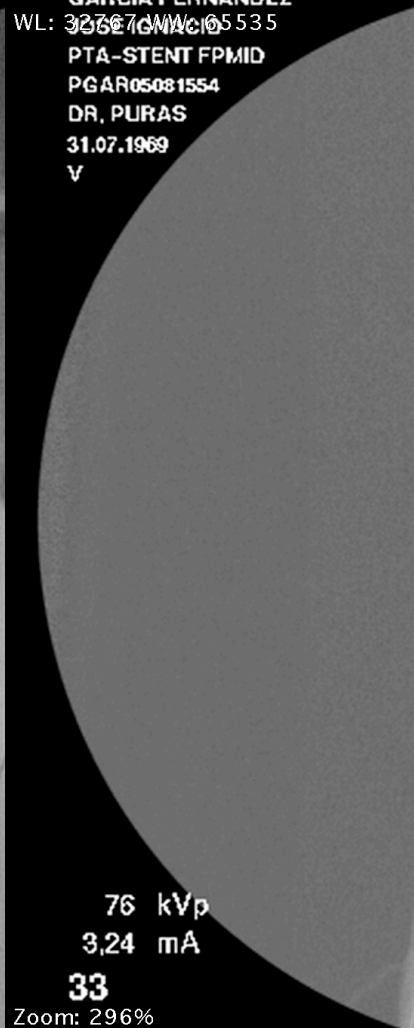
65 kVp  
1,50 mA

19

Zoom: 296%  
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No comprimido

Tamaño imagen: 512 x 512  
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CAMA: FERNANDEZ  
WL: 32767 WW: 65535

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DR, PURAS  
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76 kVp  
3,24 mA

33

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No comprimido

Tamaño imagen: 512 x 512  
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CAMA: FERNANDEZ  
WL: 32767 WW: 65535

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DR, PURAS  
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68 kVp  
4,00 mA

86

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Garcia Fernandez Jose Ignacio PGAR05081554 ( 45 y , 45 y )

HOSPITAL QUIRÓFANO

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Tamaño imagen: 512 x 512

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Garcia Fernandez Jose Ignacio PGAR05081554 ( 45 y , 45 y ) Tamaño imagen: 512 x 512

Tamaño carta: 510x512

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HOSPITAL QUIRON S.A.

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Garcia Fernandez Jose Ignacio PGAR05081554 ( 45 y , 45 y ) Tamaño imagen: 512 x 512

Tamaño carta: 510x512

WL: 32670Wc10

HOSPITAL QUIRON S.A.

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78-  
21-



67 kVp  
5,59 mA

106

Zoom: 296%

Im: 73/74

No comprimido

67 kVp  
5,59 mA

105

Zoom: 296%

Im: 72/74

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OEC

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Tamaño imagen: 960 x 720  
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 WL: 127 WW: 255

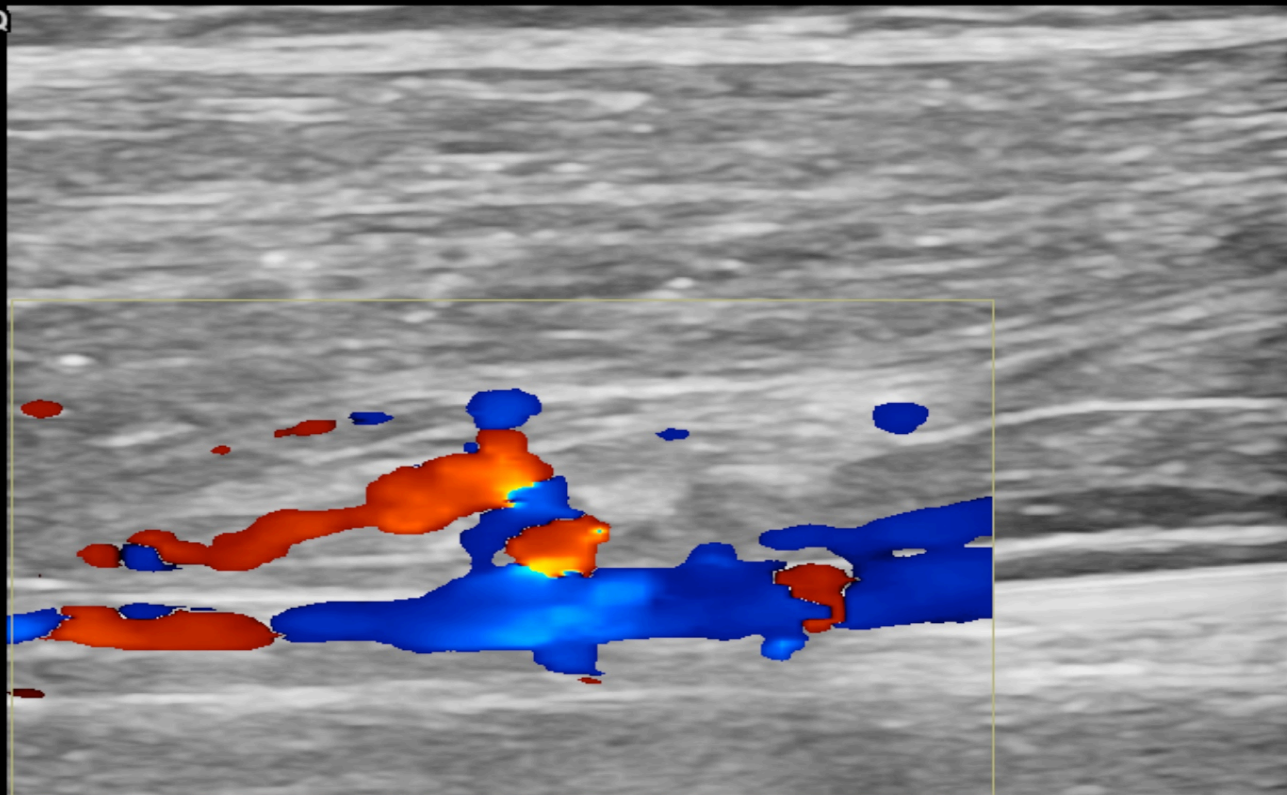
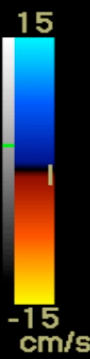
Hospital Quirón Madrid MI 1.3 TIs 0.7 9L ILLUMENATE-3 ( -, - )  
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 Frec. 10.0  
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 D 3.5

**CF**  
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 Gn 27.0  
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 PRF 2.1  
 WF 212  
 S/P 4/12

LOGIQ  
 S8



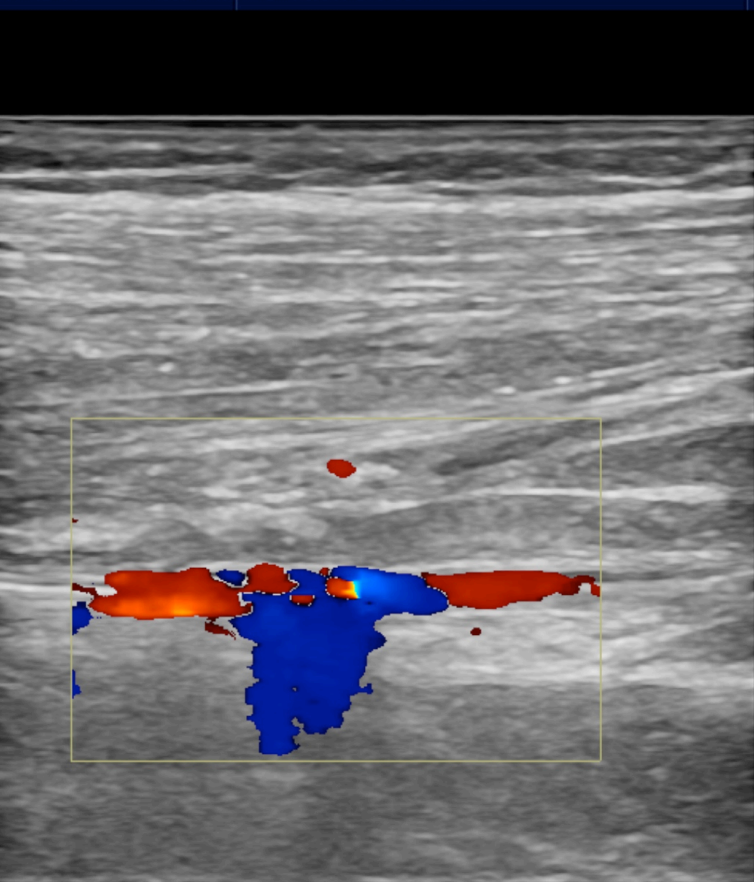
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 Tamaño imagen: 960 x 720  
 Tamaño vista: 2031 x 1523  
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 MI 1.3 TIs 0.7 9L  
 LEA

PGAR05081554  
 DR, PURAS  
 31.07.1969  
 V  
 66 kVp  
 2,24 mA  
 107  
 Zoom: 296%  
 Im: 74/74  
 No comprimido

LOGIQ S8  
 LOGIQ S8  
 25  
 -25 cm/s  
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 Zoom: 212% Angulo: 0  
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 Im: 36/50  
 No comprimido  
 No comprimido



FR	15
AO%	100
<b>CHI</b>	
- Frec.	10.0
- Gn	61
- D	4.5
<b>1- CF</b>	
- Frec.	5.0
- Gn	27.0
- L/A	1/5
- PRF	3.4
<b>2- WF</b>	344
- S/P	4/12
<b>3- </b>	
<b>4-</b>	

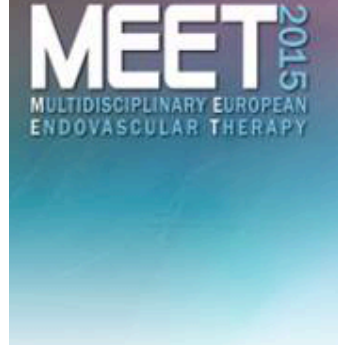
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Made In OsiriX



# Completion duplex ultrasound predicts early graft thrombosis after crural bypass in patients with critical limb ischemia



Salvatore T. Scali, MD,<sup>a</sup> Adam W. Beck, MD,<sup>a</sup> Brian W. Nolan, MD,<sup>b,c</sup> David H. Stone, MD,<sup>b</sup>  
 Randall R. De Martino, MD,<sup>b</sup> Catherine K. Chang, MD,<sup>a</sup> Eva M. Rzucidlo, MD,<sup>b</sup> and  
 Daniel B. Walsh, MD,<sup>b</sup> Gainesville, Fla; and Lebanon, NH

JOURNAL OF VASCULAR SURGERY  
 October 2011

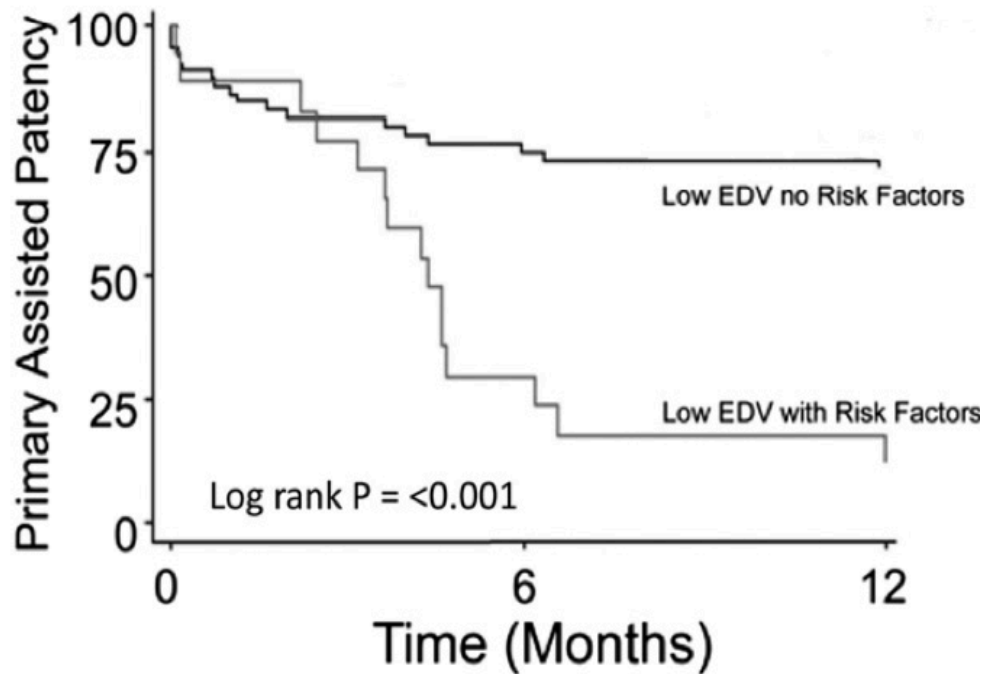


Fig. Primary-assisted patency stratified by end-diastolic velocity (*EDV*) ( $\pm$  other risk predictors).

Table I. One-year bypass patency stratified by distal graft end-diastolic velocity (*EDV*)

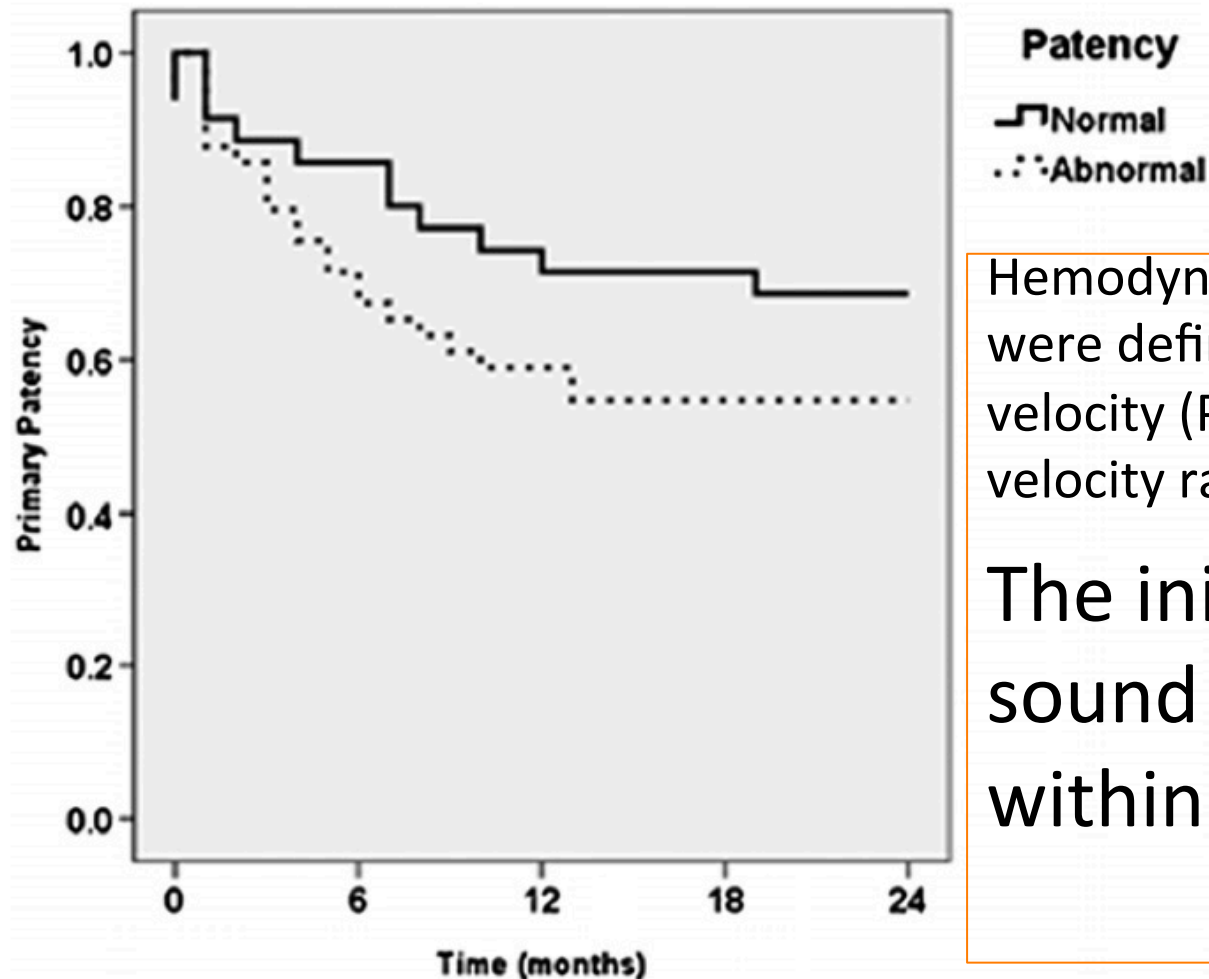
<i>EDV category</i>	<i>Primary</i>	<i>Primary-assisted</i>	<i>Secondary</i>
EDV >15 cm/s (28 <sup>a</sup> )	84%	88%	88%
EDV 5–15 cm/s (41 <sup>a</sup> )	64%	70%	72%
EDV < 5 cm/s (22 <sup>a</sup> )	32%	32%	38%
<i>P</i> value	.04	.001	.003



# Early duplex scanning after infrainguinal endovascular therapy

Misty D. Humphries, MD, William C. Pevec, MD, John R. Laird, MD, Khung Keong Yeo, MD, Nasim Hedayati, MD, and David L. Dawson, MD, *Sacramento, Calif*

JOURNAL OF VASCULAR SURGERY  
 February 2011



Hemodynamically significant lesions were defined as a peak systolic velocity (PSV) >180 cm/s or PSV velocity ratio >2.0.

The initial duplex ultrasound study was done within **30 days**

PTA PROCEDURE

PTA-SITE ARTERIOGRAM

ABNORMAL

NORMAL

**INTRAOPERATIVE DECISION**

RESIDUAL ESTENOSIS  
PSV < 180 CM/SEG  
Vr < 2

RESIDUAL ESTENOSIS  
PSV 180-300 CM/SEG  
Vr > 2

--160 --400--  
--120 --300--  
cm/s

# ABNORMAL DUPLEX FINDINGS

- No Flow
- Monophasic flow, low amplitude, AT retarded
- EDV < 5 cm/seg
- PSV > 180-200 cm/seg
- PSV Ratio >2-2,5
- Other non hemodynamic: AVF; “bleeding”, pseudoaneurysm.....



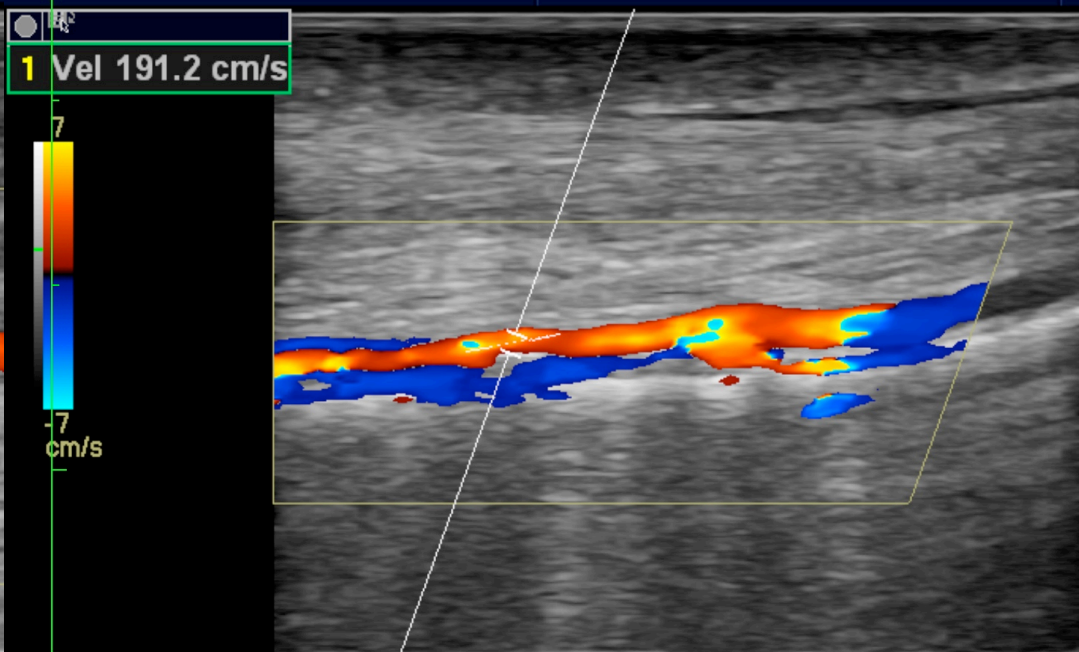
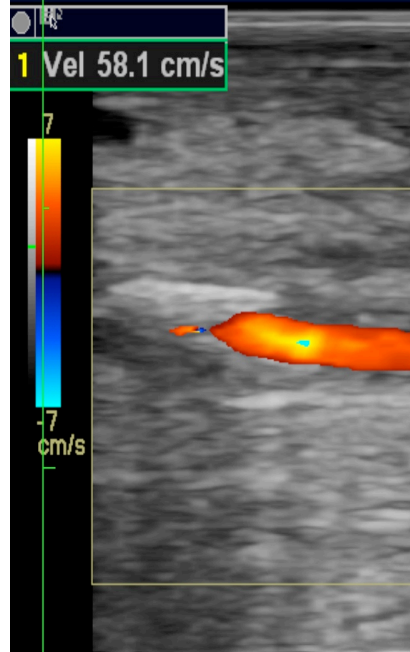
# PSV ratio > 3 → Re-angioplasty

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Tamaño vista: 2031 x 1523  
WL: 127 WW: 255

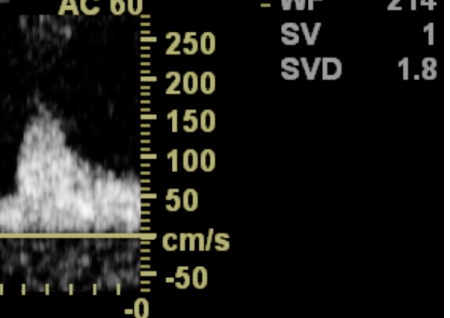
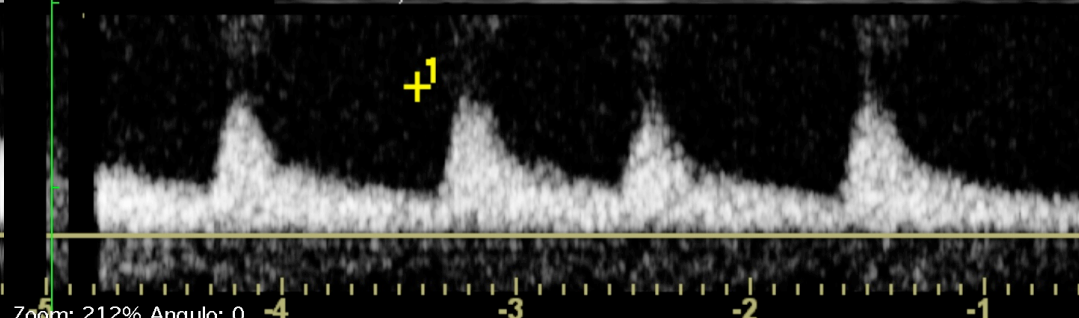
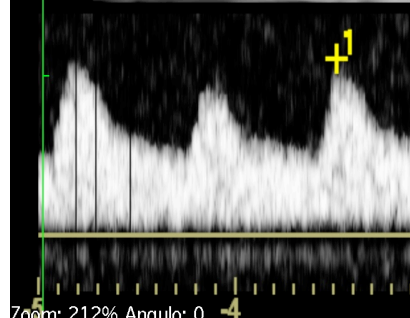
Tamaño imagen: 960 x 720  
Tamaño vista: 2031 x 1523  
WL: 127 WW: 255

CUTULU,  
VIABAHN FEM POP ADM

MI 1.0 TIs 0.4 9L  
VIABAHN FEM POP ( -, - )  
-- unnamed  
LEV 0



FR	12
AO%	100
CHI	
Frec.	10.0
1-Gn	59
D	3.5
CF	
Frec.	4.2
2-Gn	28.0
PRF	0.8
WF	98
PW	
Frec.	4.2
3-Gn	45
PRF	9.8
WF	214
SV	1
SVD	1.8



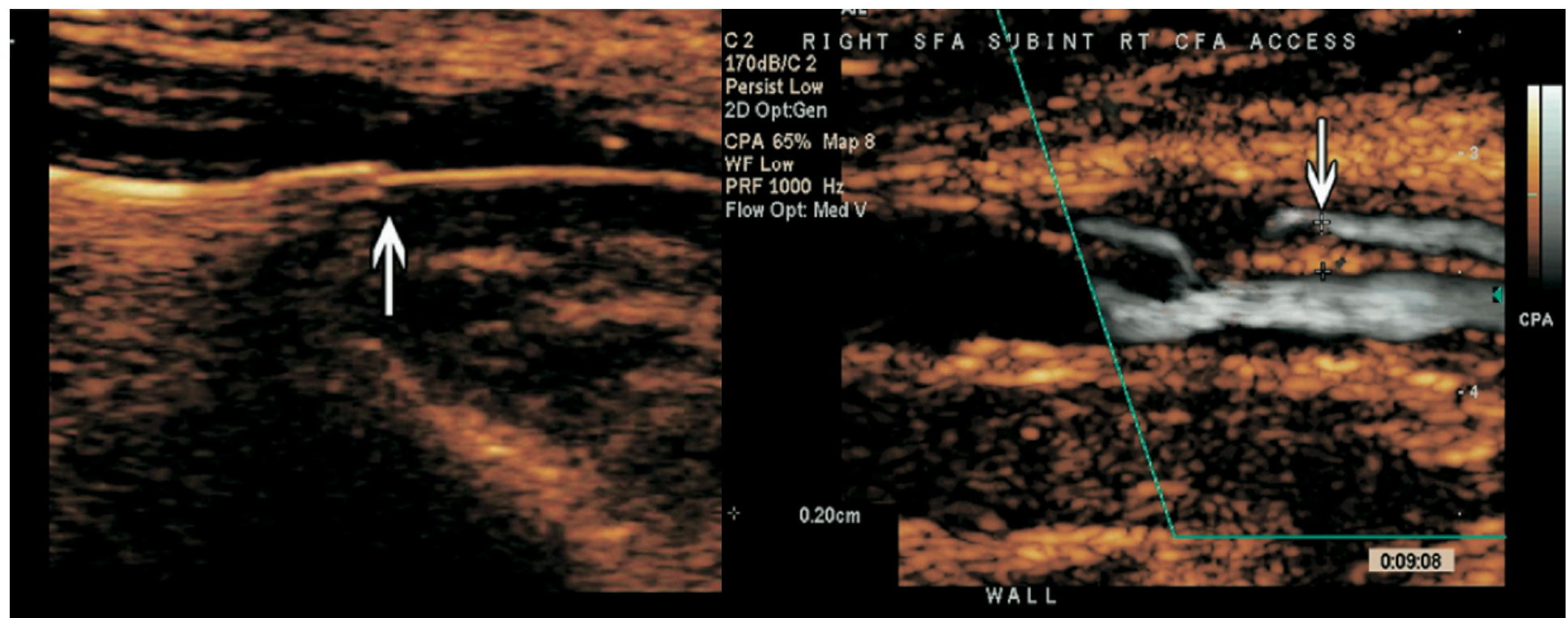
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# Duplex-guided endovascular treatment for occlusive and stenotic lesions of the femoral-popliteal arterial segment: A comparative study in the first 253 cases

Enrico Ascher, MD, Natalie A. Marks, MD, RVT, Anil P. Hingorani, MD, Richard W. Schutzer, MD, and Manikyam Mutyala, MD, *Brooklyn, NY*



# Duplex-guided endovascular treatment for occlusive and stenotic lesions of the femoral-popliteal arterial segment: A comparative study in the first 253 cases

**MEET** 2015  
MULTIDISCIPLINARY EUROPEAN  
ENDOVASCULAR THERAPY

JOURNAL OF VASCULAR SURGERY  
December 2006

Enrico Ascher, MD, Natalie A. Marks, MD, RVT, Anil P. Hingorani, MD, Richard W. Schutzer, MD, and Manikyam Mutyala, MD, *Brooklyn, NY*

<i>No. cases</i>	<i>Procedure/difficulty</i>	<i>Duplex assistance</i>
3	Failed re-entry to popliteal artery during subintimal dissection of SFA	Confirmation of wire position in the false popliteal lumen
2	“Flush” SFA occlusion	Initiation of subintimal dissection
2	Popliteal stenosis in patient with knee prosthesis	Popliteal artery angioplasty
1	Severe stenosis of the SFA origin in patient with hip prosthesis	SFA cannulation
1	Peroneal artery subintimal dissection	Confirmation of wire position in the true peroneal lumen
1	Guidewire deviation from the occluded SFA anatomic location	Guidewire found to be in the short occluded prosthetic bypass (not identified before surgery)
1	Failure to enter SFA occlusion with the guidewire at the midhigh level	Absent SFA (ligated after old war injury), procedure aborted

“Both techniques offer different information and can be complementary to each other”.

## Duplex-guided infrainguinal balloon angioplasty and stenting.

A 4-year experience.

Ascher E, Marks NA, Hingorani AP. J Cardiovasc Surg (Torino).

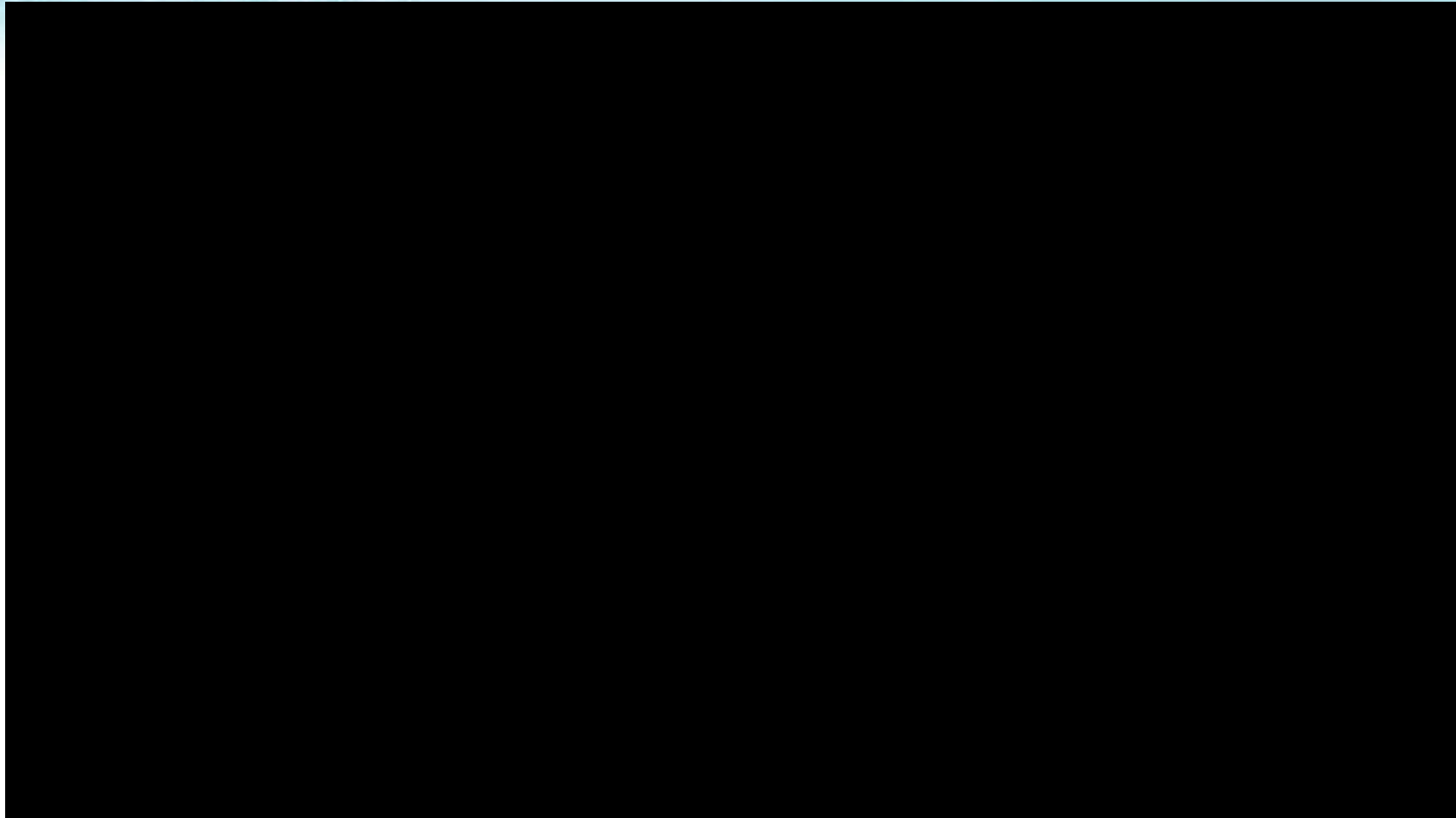
2008 Apr;49(2):151-8.

Technical success :

- femoral-popliteal segment was 95%  
(342/360 cases)
- infrapopliteal segment was 96%  
(77/80 cases)

“Duplex guided balloon angioplasty and stent placement appears to be a safe and effective technique for treatment of femoral-popliteal and infrapopliteal arterial occlusive disease”.

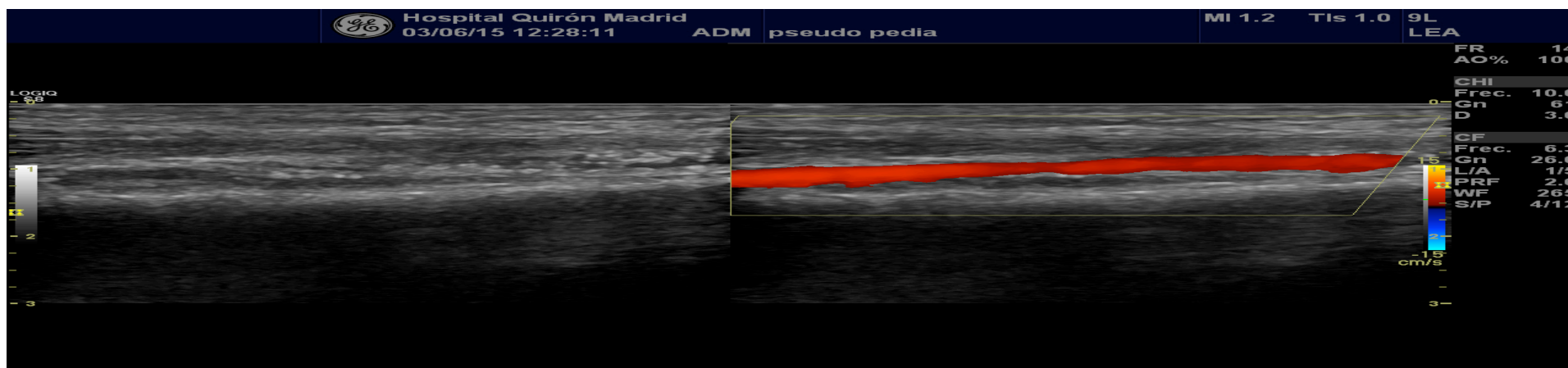
# USG approach : Closure device





# Conclusions

- Duplex scans should be performed at all stages of every endovascular case
- To confirm technical adequacy of the procedure
- To help assess significance of residual stenoses
- To rule-out distal embolization
- To check the proximal or distal access points



# Conclusions

In our practice, duplex scanning has evolved from an essential diagnostic and surveillance tool to an integral part of endovascular interventions

