SID
Società Italiana di Diabetologia
fondata nel 1964

AMD
ASSOCIAZIONE MEDICI DIABETOLOGI
1974

CONGRESSO NAZIONALE PIEDE DIABETICO GDS AMD-SID
"LA SINDROME DEL PIEDE DIABETICO:
COMPETENZE IN AZIONE CON UNO SGUARDO AL FUTURO"
Assisi (PG) 15 - 17 giugno 2023

Il Piede Ischemico: La Rivascolarizzazione Chirurgica

Daniele Adami MD, FEBVS
U.O.Chirurgia Vascolare
Azienda Ospedaliero Universitaria Pisana

Limb ischemia: really need Surgery Nowdays?

High patient's risk
Time consuming procedures
Long recovery times

Limb ischemia: really need Surgery Nowdays?





But.....

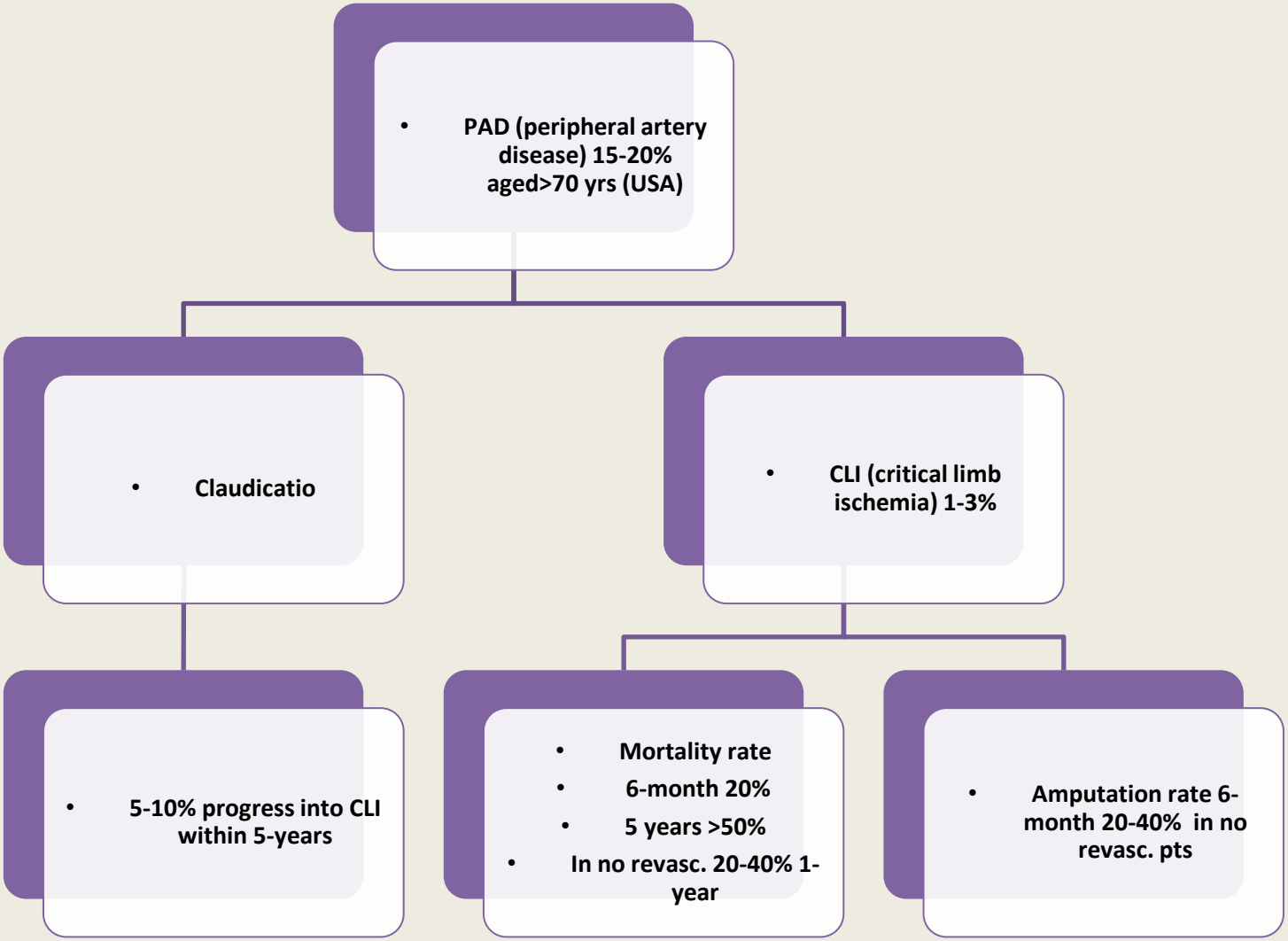


1.Life expectancy

2.High recurrences (vascular and foot injuries)

3.Advanced complicated foot lesions

Surgical Lower Limb Revascularization



AmJHeart 2002, NEngJMed 1992, Lancet 2005, JVascSurg 2015 TASCII 2007 EurJEndovascSurg 2011

Peripheral Arteries

Eur J Vasc Endovasc Surg (2021) 62, 225–232

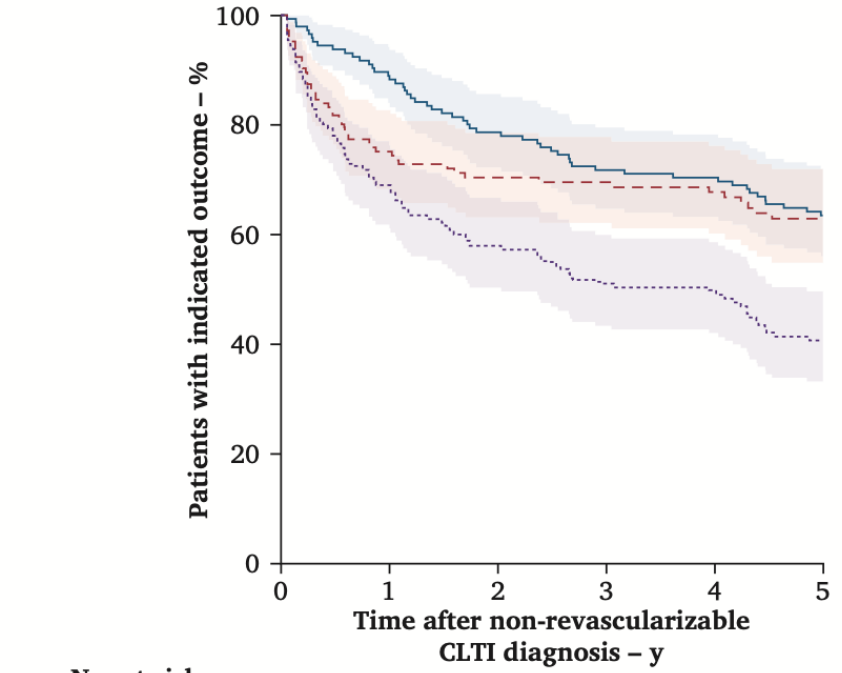
EJVES Open Access

Long Term Survival and Limb Salvage in Patients With Non-Revascularisable Chronic Limb Threatening Ischaemia

Maarten C. Verwer [a], Joep G.J. Wijnand [a], Martin Teraa [a], Marianne C. Verhaar [b], Gert J. de Borst [a,*]

[a] Department of Vascular Surgery, University Medical Centre Utrecht, Utrecht, The Netherlands
[b] Department of Nephrology & Hypertension, University Medical Centre Utrecht, Utrecht, The Netherlands

64% al 5 yrs!



Editorial

J Atheroscler Thromb, 2021; 28: 467-468. http://doi.org/10.5551/jat.ED138

Two-year Mortality in CLTI Patients Provide Crucial Factors We Should Fight

Yoshimitsu Soga

Department of Cardiology, Kokura Memorial Hospital, Fukuoka, Japan

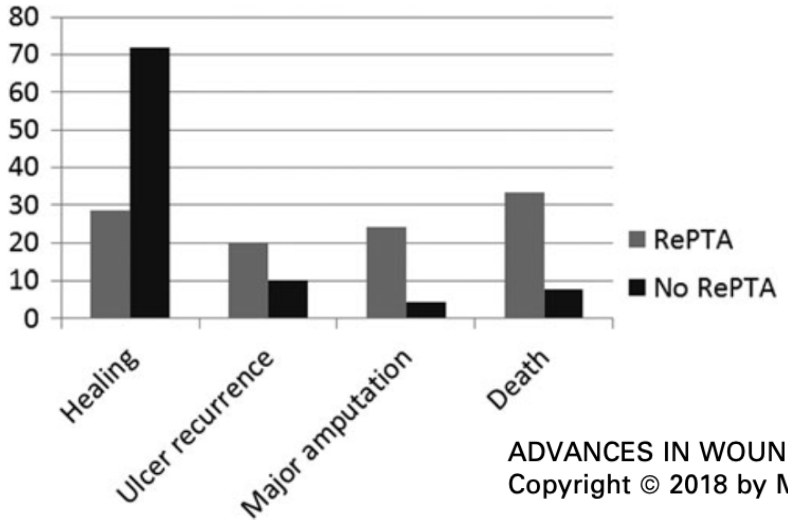
agement of the CLTI treatment. We can divide the two causes of death into the two following treatment phases: acute and chronic. In the acute phase, the first battle against infectious diseases begins. To achieve complete wound healing, it is important to administer broad antibiotics, in addition to adequate debridement and minor amputation, to control the infection. During wound care, contracting an infectious disease such as sepsis can often be lethal. Especially, after successful revascularization, the risk of sepsis increases because of the spread of the closed focal infection.

Recurrence of Critical Limb Ischemia After Endovascular Intervention in Patients with Diabetic Foot Ulcers

Marco Meloni,[1,*] Valentina Izzo,[1] Laura Giurato,[1] Costantino Del Giudice,[2] Valerio Da Ros,[2] Valerio Cervelli,[3] Roberto Gandini,[1] and Luigi Uccioli[1]

Departments of [1]Systems Medicine, [2]Interventional Radiology, and [3]Plastic and Reconstructive Surgery, University of Tor Vergata, Rome, Italy.

1.Of 304 patients 24.3% needed re-PTA after the first treatment.
2.The mean time to rePTA was 3.5 – 0.64 months.
3.In 70/74 (94.2%) restenosis/occlusion vessels treated.



ADVANCES IN WOUND CARE, VOLUME 7, NUMBER 6
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Prognostic Impact of Revascularization in Poor-Risk Patients With Critical Limb Ischemia The PRIORITY Registry (Poor-Risk Patients With and Without Revascularization Therapy for Critical Limb Ischemia)
J Am Coll Cardiol Intv 2017;10:1147–57

Considerations on Endo revascularized group

After revascularization, 31.0% had residual pain and 25.0% experienced perioperative complications, whereas 93.2% obtained initial technical success

During the follow-up after registration, lower-limb intervention was performed as frequently as 2.4 (95% CI: 2.1 to 2.7) times per person-year in the revascularized group



Eur J Vasc Endovasc Surg (2018) 55, 666–671

Editor's Choice — A Comparison of Clinical Outcomes Between Primary Bypass and Secondary Bypass After Failed Plain Balloon Angioplasty in the Bypass versus Angioplasty for Severe Ischaemia of the Limb (BASIL) Trial

Lewis Meecham [a,*], Smitaa Patel [b], Gareth R. Bate [a], Andrew W. Bradbury [a]

RCT

48.2%!!!

46 (19.3%) BP

238 PBA → 69 (28.9%) 2° PBA → 3 BP

17 (7.1%) 3° PBA

7 (2.9%) 4° PBA

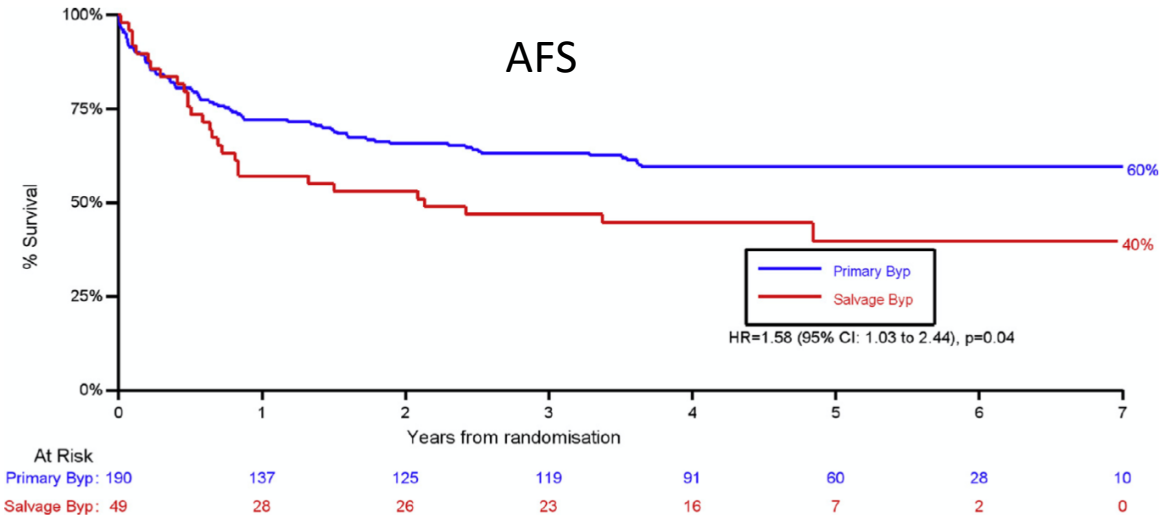


Figure 1. Comparison of amputation free survival in patients undergoing primary and secondary bypass in the BASIL trial.

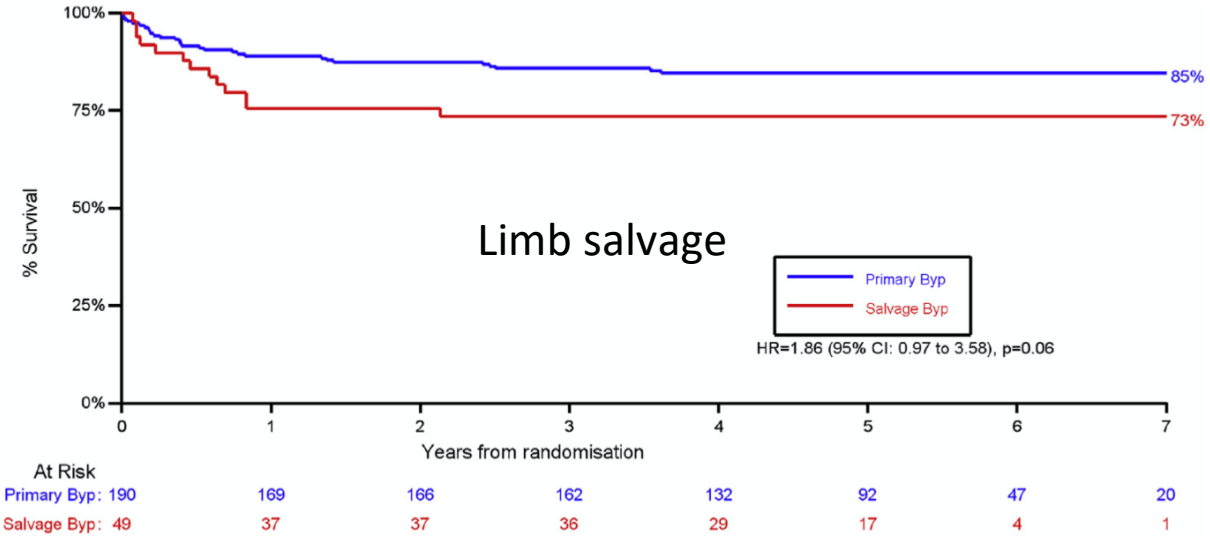


Figure 2. Comparison of limb salvage in patients undergoing primary and secondary bypass in the BASIL trial.

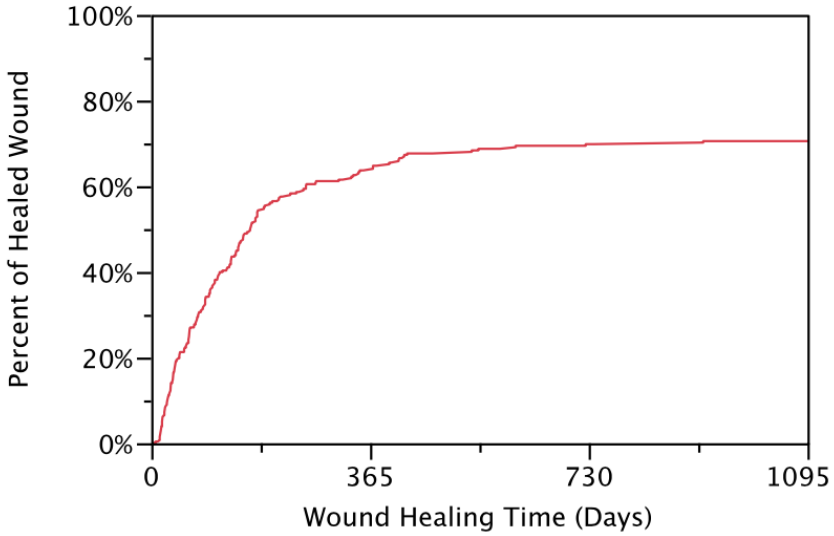
"indicate that primary endovascular intervention is not the "free shot" that it has so often been claimed to be. "

Analysis of wound healing time and wound-free period as outcomes after surgical and endovascular revascularization for critical lower limb ischemia

Jin Okazaki, MD, PhD,[a] Daisuke Matsuda, MD,[a] Kiyoshi Tanaka, MD, PhD,[a] Masaru Ishida, MD, PhD,[a] Sosei Kuma, MD, PhD,[b] Koichi Morisaki, MD, PhD,[c] Tadashi Furuyama, MD, PhD,[c] *and* Yoshihiko Maehara, MD, PhD,[c] *Kitakyushu, Koga, and Fukuoka, Japan*

Journal of Vascular Surgery
March 2018





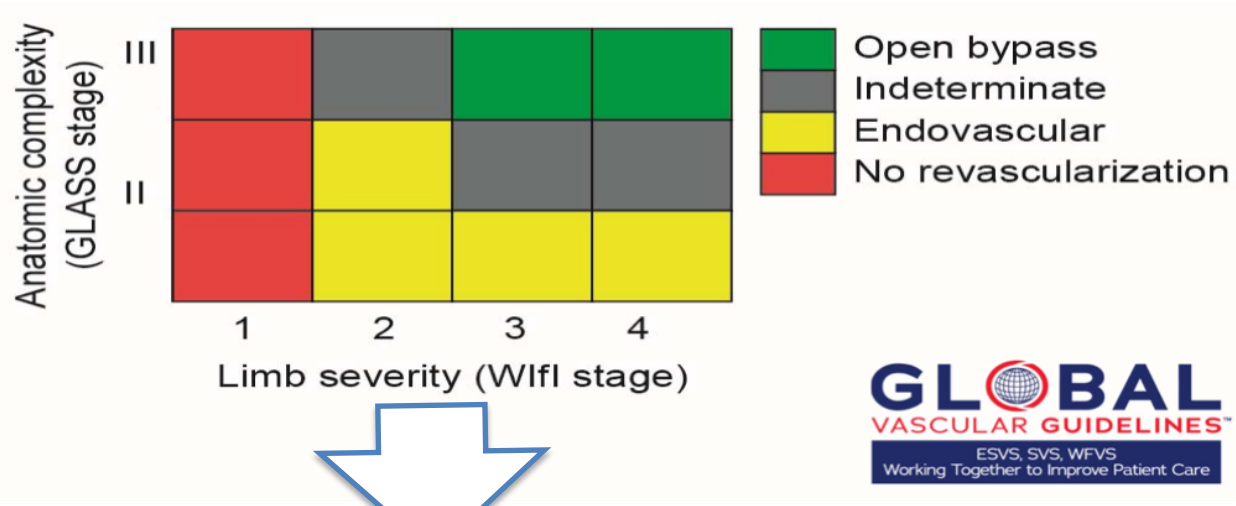
	1 years	2 years	3 years
Healed wound (%)	64.0	69.7	70.5
Limbs at risk	101	85	83

Revascularizition Decision making

WIfI stage

DUAM

Preferred initial revascularization strategy:
average risk CLTI patient with available GSV



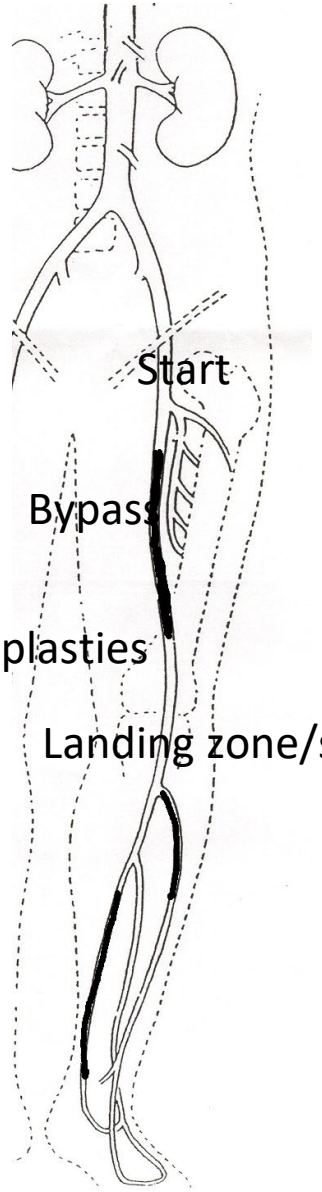
Vein availability

Perioperative mortality/morbidity risk

Life expectancy

Revascularization proposal

Revascularization Planning



- Ancillary procedures
- Inflow (endo/stent)
- Endoarterectomy +/-
- Vein: GSF>spliced GSV>Armsvein>SSV
- Bioprosthesis
- Prosthetic Allograft
- Angioplasties



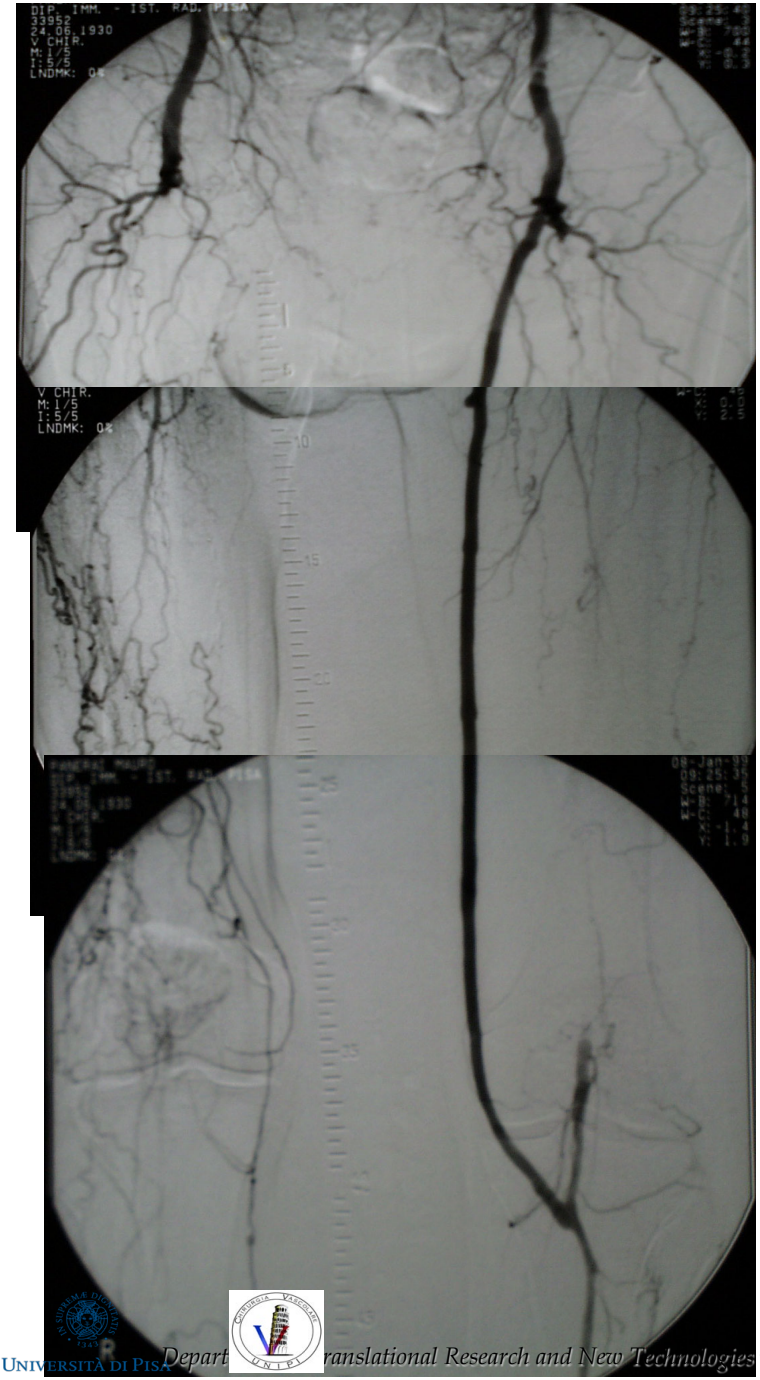
FOOT needs/surgery

How to do
Surgical revascularization?

- By pass
- Endoarterectomy
- Hybrid approach surgical+endo

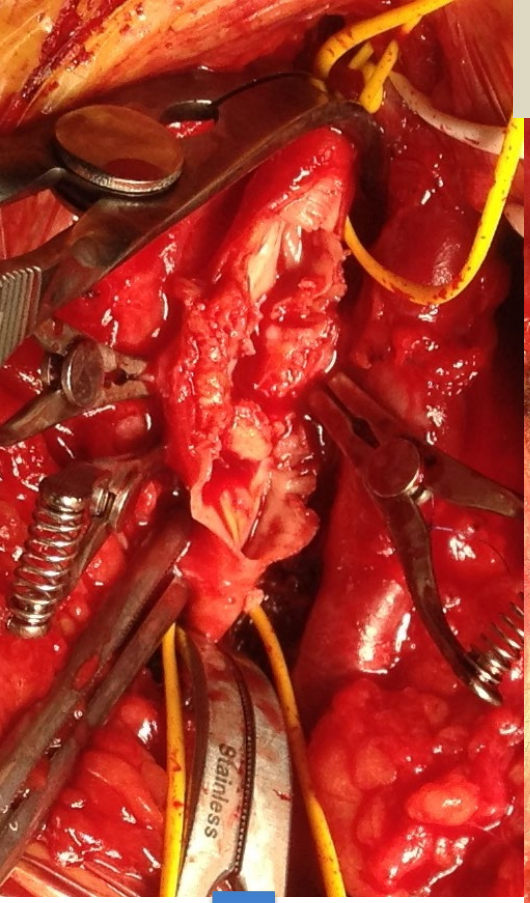


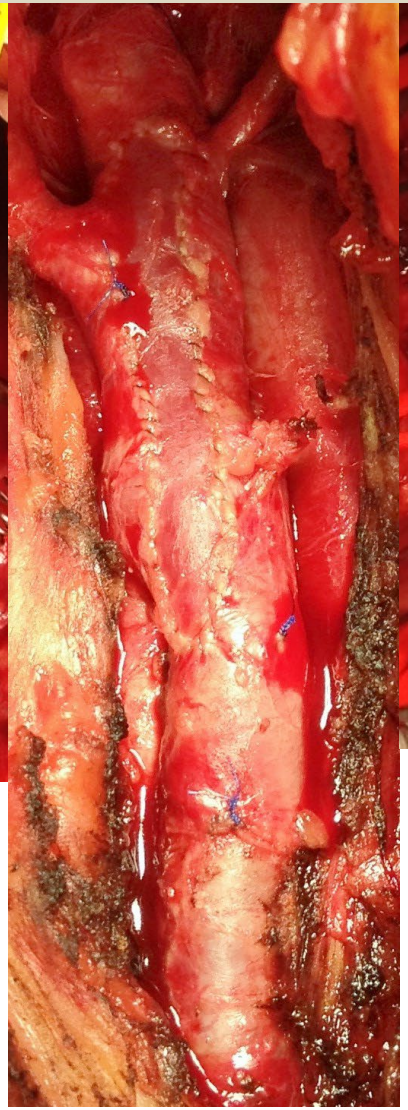
Is the past?!?





Endoarterectomy



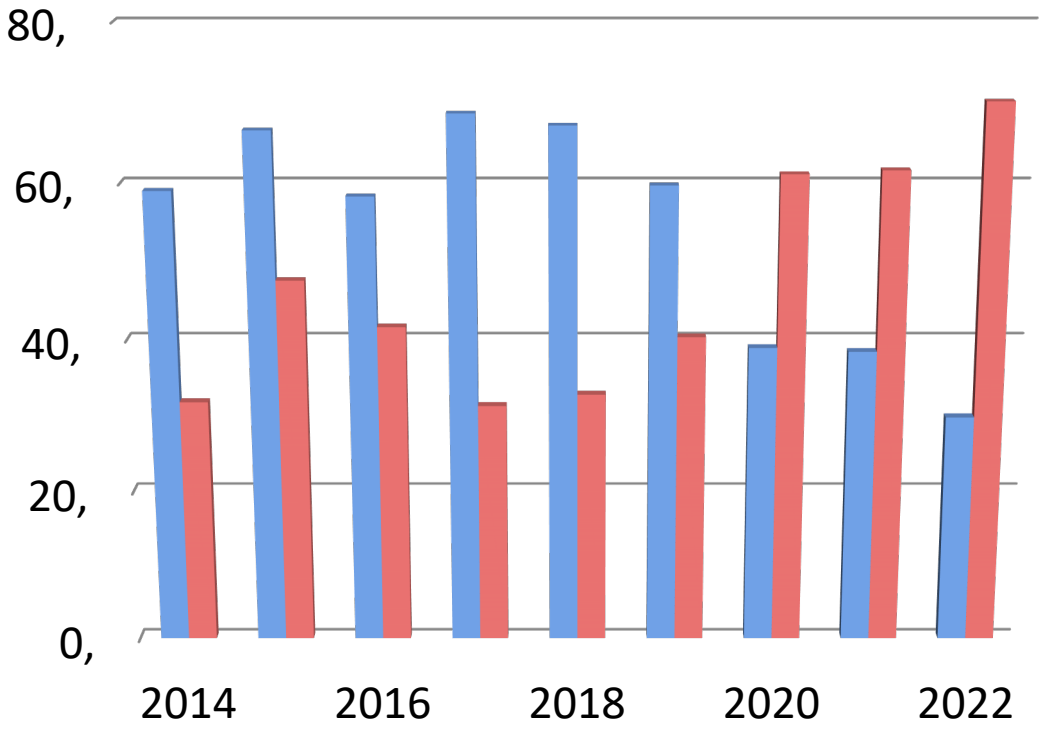




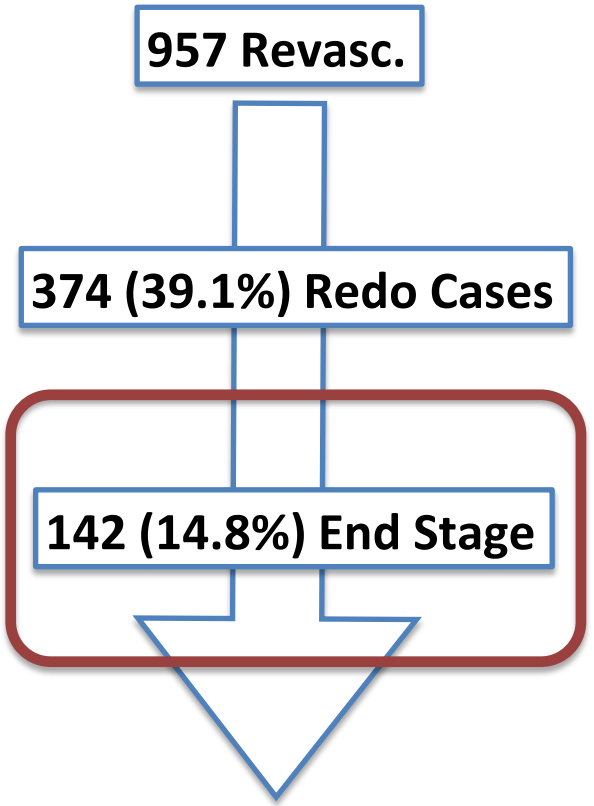


Is the past?!?

Trend of Surgical Bypass complexity: Below Knee Bypass rate/yr







CLTI

2014-2022

- Previous revascularizations (≥2)
- Indication for above ankle amputation
- LF IV, Rutherford ≥5, WIfI class 4

? XL

ExtraLarge
EXTReme Approaches for Lowerlimb Arterilization: Ground Experience

1 Bifurcated bypass in severe chronic limb threatening ischemia: the purposes

88 limbs

- Get the best foot perfusion in high grade WIfI stages: is the last chance
- Revascularize all diseased angiosomes
- Use all the vein to cover any revascularization opportunities
- Improve long term bypass patency through wider outflow

Original Article

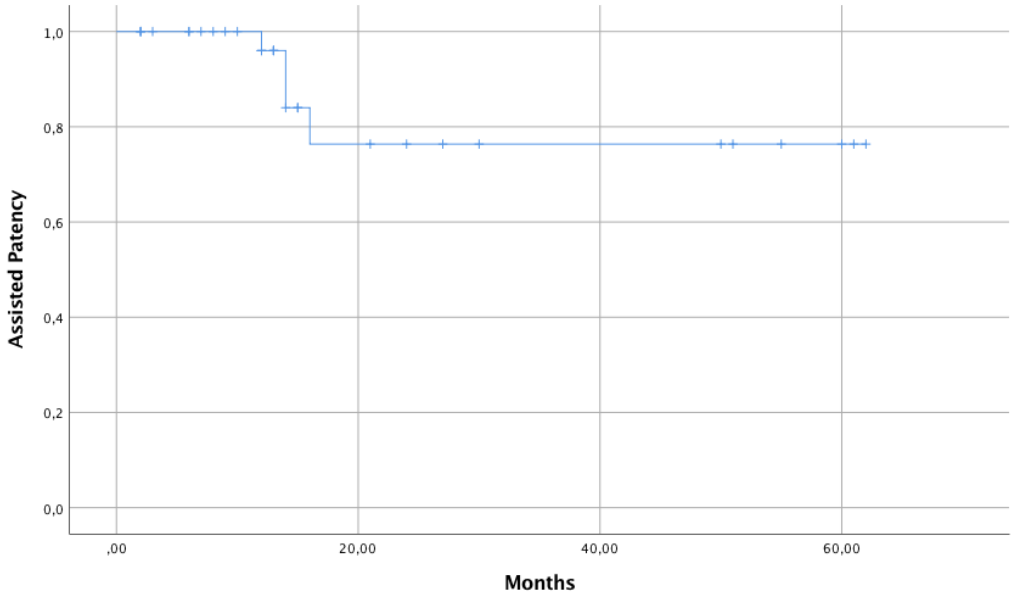
Vascular

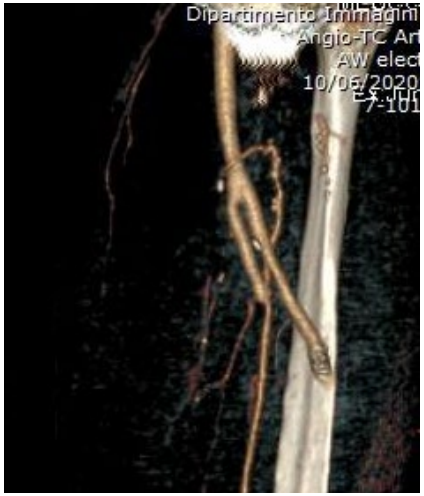
Bifurcated bypass in severe chronic limb threatening ischaemia

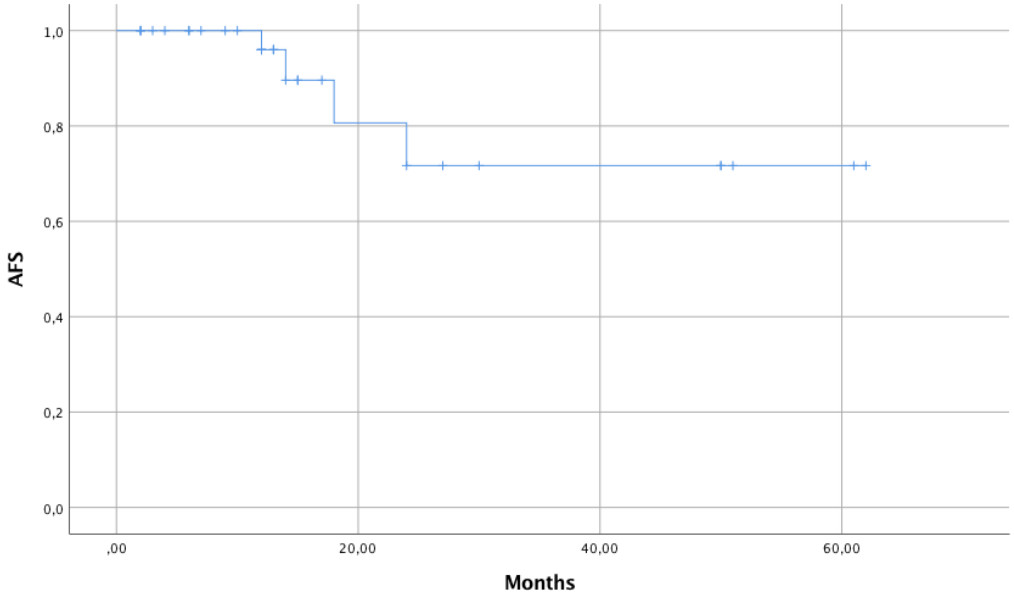
Vascular
0(0) 1–9
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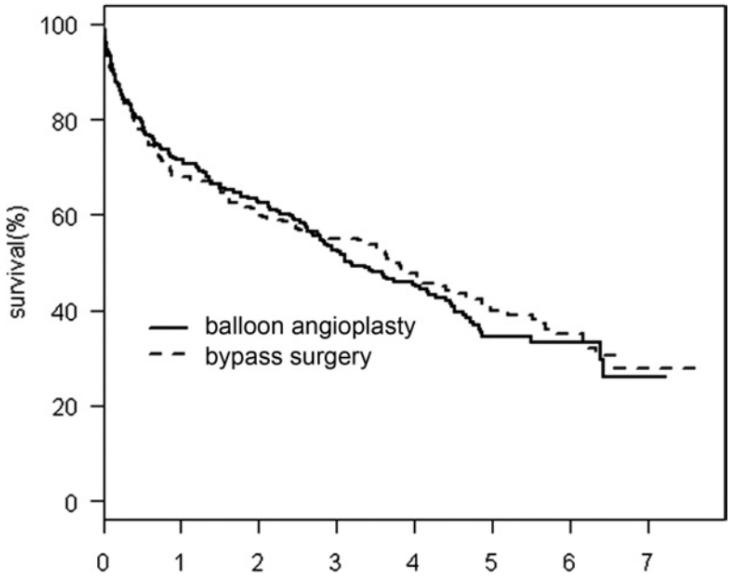
Daniele Adami[1], Michele Marconi[1], Alberto Piaggesi[2], Davide M Mocellin[1], Raffaella N Ber[illegible]



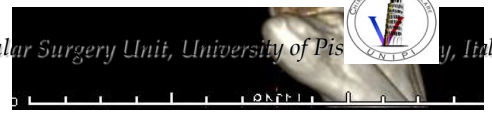








At risk								
Balloon angioplasty	224	160	139	117	87	41	16	5
Bypass surgery	228	154	138	124	93	53	24	6



AZIENDA OSPEDALIERO UNIVERSITARIA PISANA

U.O. CHIRURGIA VASCOLARE

VISITA CHIRURGICA VASCOLARE ED ECOCOLOR DOPPLER ARTI INFERIORI

Pisa, 17/01/2023

Sig. _____ Data di nascita 31/10/1968

Domicilio _____

Tel: _____

Provenienza: Domicilio □, Reparto AUOP□, Altro Ospedale/Casa di Cura□ RSA □

Motivo della visita: **Gangrena V raggio, Gangrena calcagno**

Patologie Associate: **DM tipo 1 12 aa, Dialisi da 21 aa, retinopatia diabetica, PTCA 2001**

Terapia

Lateralità: DX□ SX X Entrambi □: specificare quale più grave

Stadiazione arteriopatia ostruttiva cronica

Classificazione Leriche-Fontaine[1]: IIa□; IIb□; III□; IV X

Classificazione Rutherford[2] 0-6: **5**

Deambula: SI X NO□ Allettato SI□ NO□

ABI: DX SX AP: DX SX mmHg **20 mmHg TP**

WIfi

Table 7. Assessment of the risk of amputation: the WIFI classification (for further details see Mills *et al*[317]).

Component	Score	Description		
W (Wound)	0	No ulcer (ischaemic rest pain)		
	1	Small, shallow ulcer on distal leg or foot without gangrene		
	X	Deeper ulcer with exposed bone, joint or tendon ± gangrenous changes limited to toes		
		Extensive deep ulcer, full thickness heel ulcer ± calcaneal involvement ± extensive gangrene		
I (Ischaemia)		ABI	Ankle pressure (mmHg)	Toe pressure or $TcPO_2$
	0	≥0.80	> 100	≥60
	1	0.60–0.79	70–100	40–59
	X	0.40–0.59	50–70	30–39
		<0.40	<50	<30
fI (foot infection)	0	No symptoms/signs of infection		
	X	Local infection involving only skin and subcutaneous tissue		
	2	Local infection involving deeper than skin/subcutaneous tissue		
	3	Systemic inflammatory response syndrome		

a, Estimate risk of amputation at 1 year for each combinat

	Ischemia – 0				Ischemia – 1				Ischem	
W-0	VL	VL	L	M	VL	L	M	H	L	L
W-1	VL	VL	L	M	VL	L	M	H	L	M
W-2	L	L	M	H	M	M	H	H	M	H
W-3	M	M	H	H	H	H	H	H	H	H
	fI-0	fI-1	fI-2	fI-3	fI-0	fI-1	fI-2	fI-3	fI-0	fI-1

b, Estimate likelihood of benefit of/requirement for revasc
infection can be controlled first)

	Ischemia – 0				Ischemia – 1				Ischem	
W-0	VL	VL	VL	VL	VL	L	L	M	L	L
W-1	VL	VL	VL	VL	L	M	M	M	M	H
W-2	VL	VL	VL	VL	M	M	H	H	H	H
W-3	VL	VL	VL	VL	M	M	M	H	H	H
	f-0	fI-1	fI-2	fI-3	fI-0	fI-1	fI-2	fI-3	fI-0	fI-1

fI, foot Infection; I, Ischemia; W, Wound.

Premises:

1. Increase in wound class increases risk of amputation
   other wound classification systems)
2. PAD and infection are synergistic (Eurodiale); infect
   likelihood revascularization will be needed to heal w
3. Infection 3 category (systemic/metabolic instability):
   amputation regardless of other factors (validated IDS

Four c

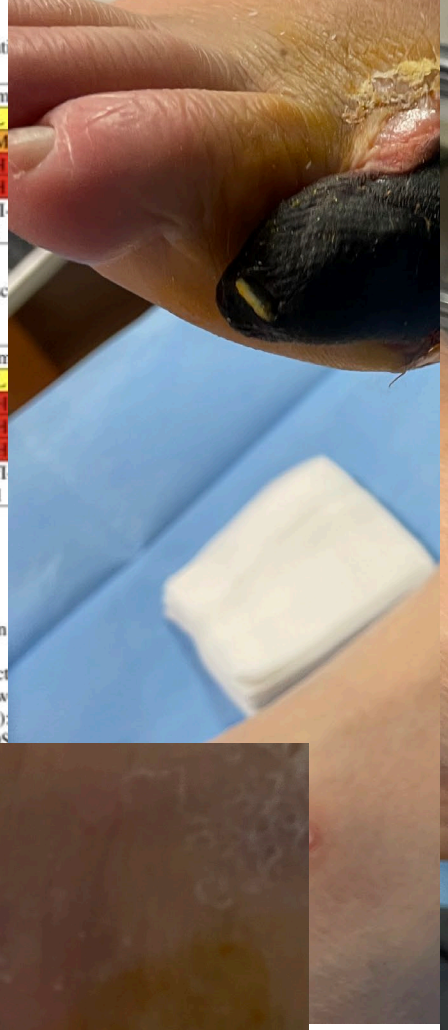
Very
Low
Mode
High
Clinic



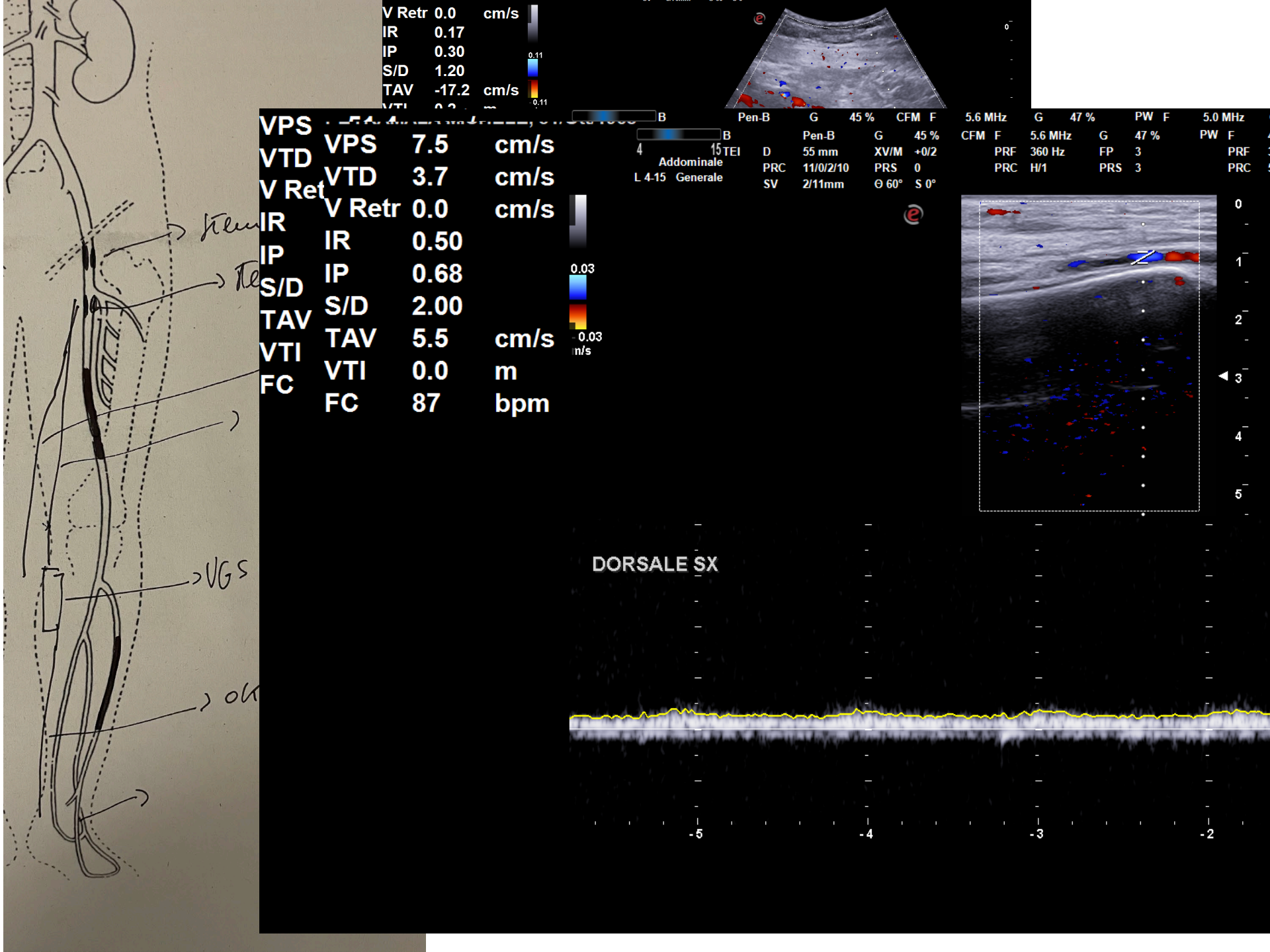
Severity of ischemia

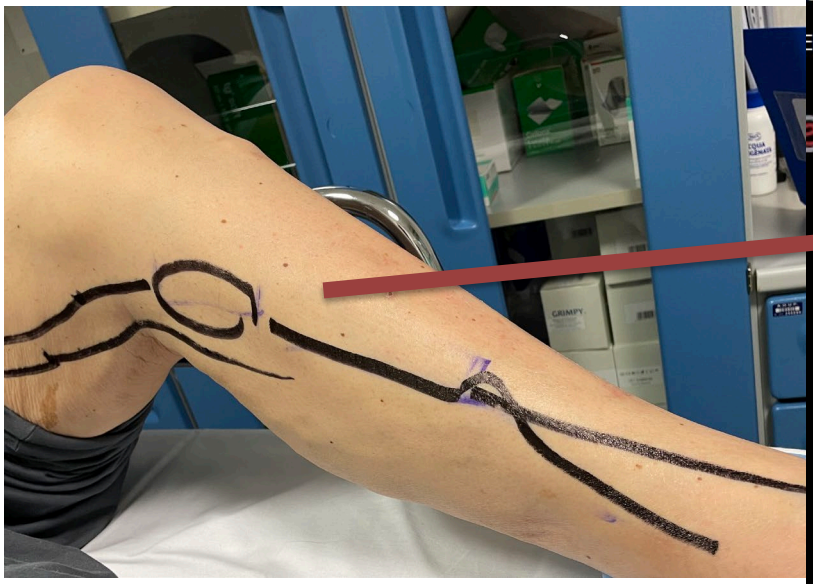
fit

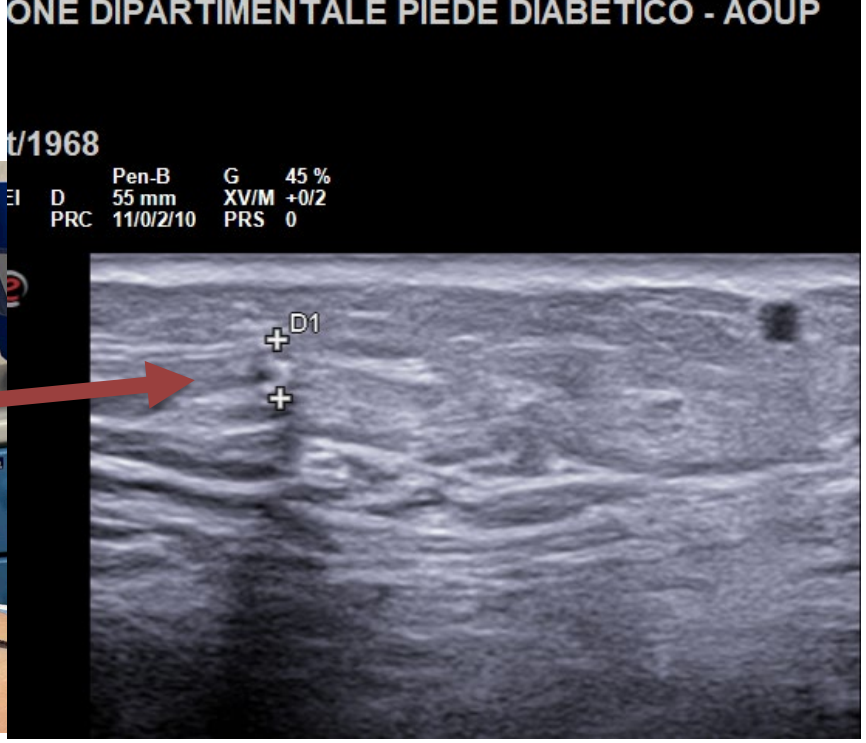
Limb severity (WIfI stage)

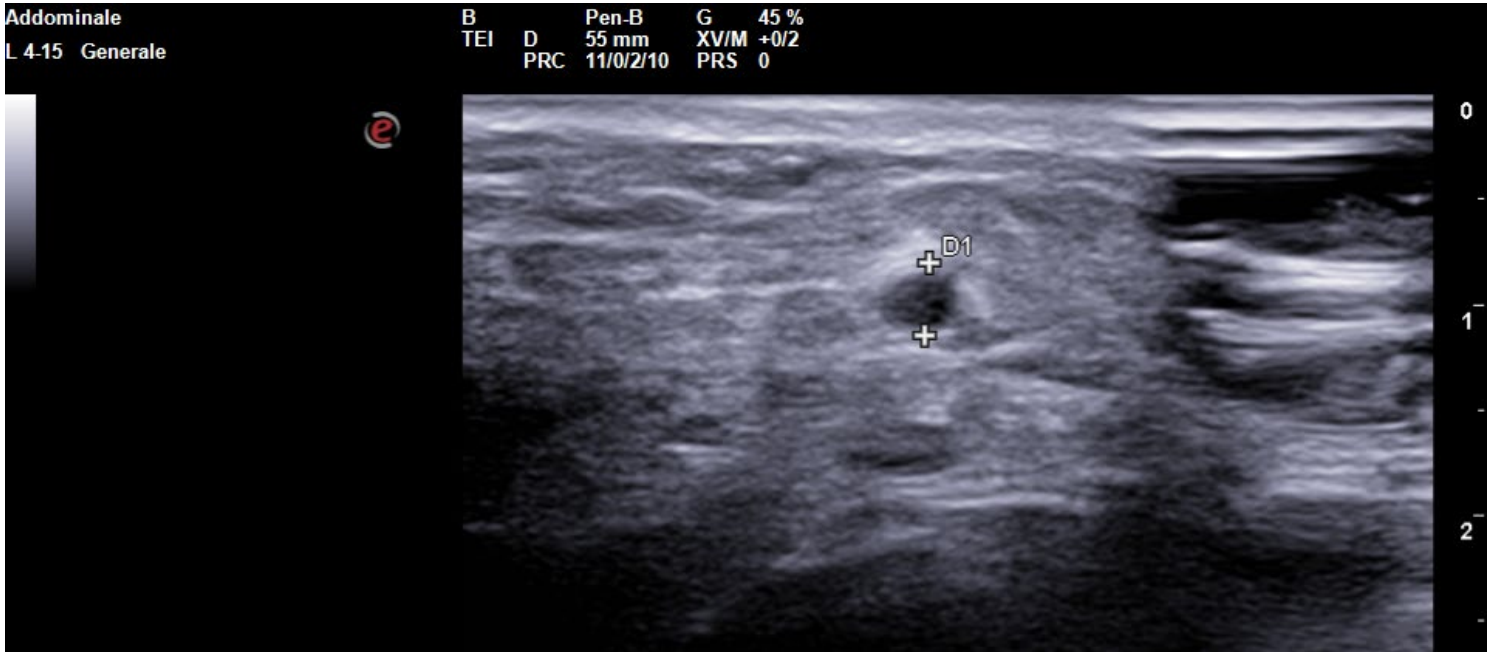





V Retr 0.0 cm/s
IR 0.17
IP 0.30
S/D 1.20
TAV -17.2 cm/s
0.11
-0.11
VPS 7.5 cm/s
VTD 3.7 cm/s
V Retr 0.0 cm/s
IR 0.50
IP 0.68
S/D 2.00
TAV 5.5 cm/s
VTI 0.0 m
FC 87 bpm
0.03
-0.03 m/s
Addominale
L 4-15 Generale
DORSALE SX
-5
-4
-3
-2




ONE DIPARTIMENTALE PIEDE DIABETICO - AOUP
t/1968
Pen-B G 45 %
D 55 mm XV/M +0/2
PRC 11/0/2/10 PRS 0
D1


Addominale
L 4-15 Generale
B Pen-B G 45 %
TEI D 55 mm XV/M +0/2
PRC 11/0/2/10 PRS 0
D1
0
1
2

Infra-malleolar/Pedal descriptor	
P0 X	Target artery crosses ankle into foot, with intact pedal arch
P1	Target artery crosses ankle into foot; absent or severely diseased pedal arch
P2	No target artery crossing ankle into foot

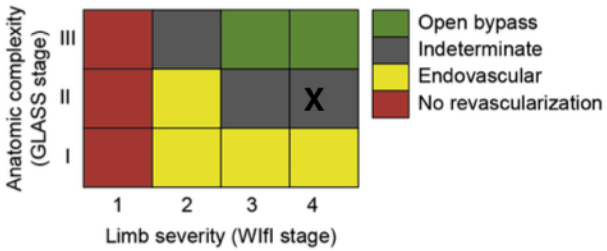
Processi decisionali:
PLAN: GLASS+Patient's risk

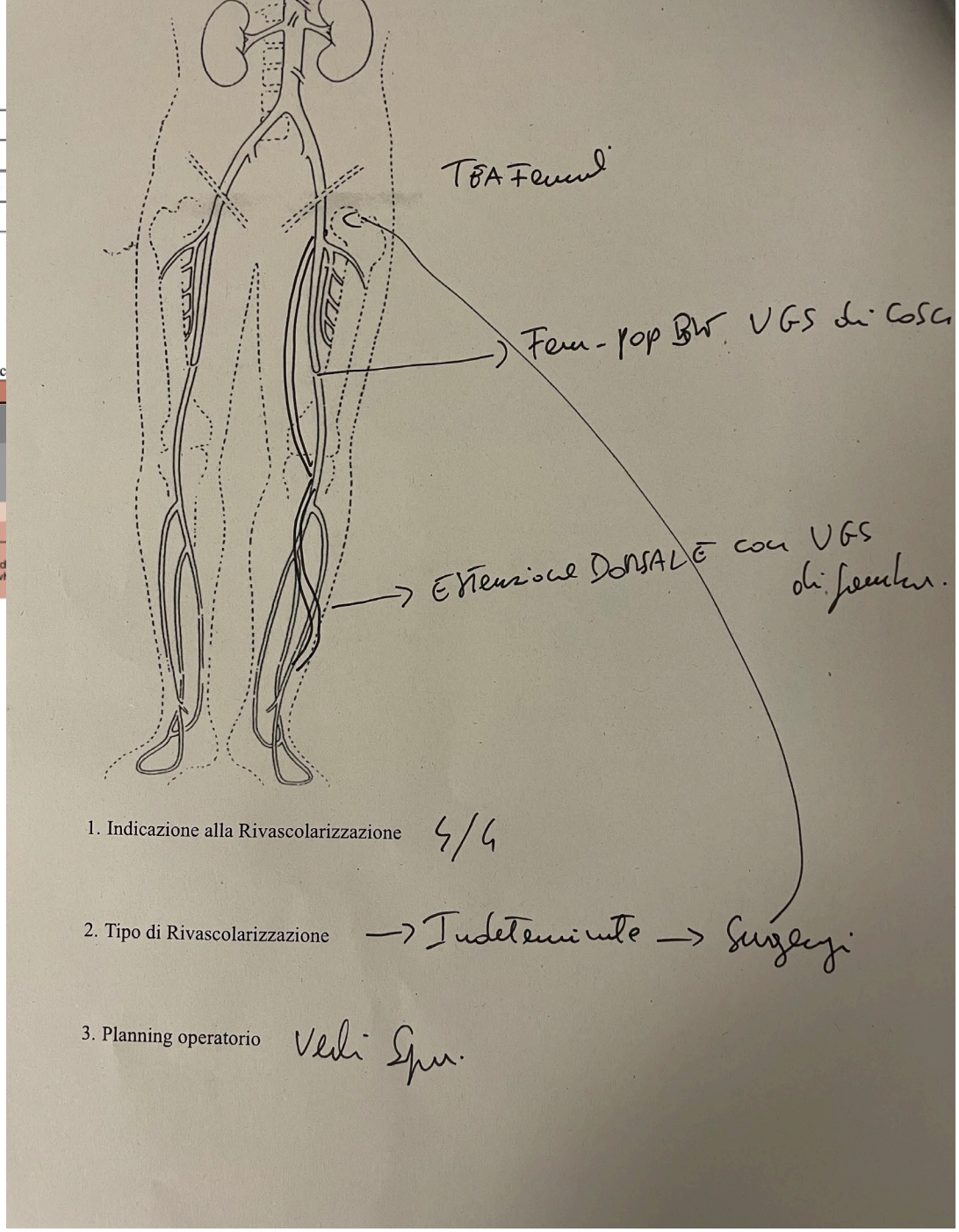
Definizione della complessità della rivascolarizzazione integrando punteggio sopra e sottogenic

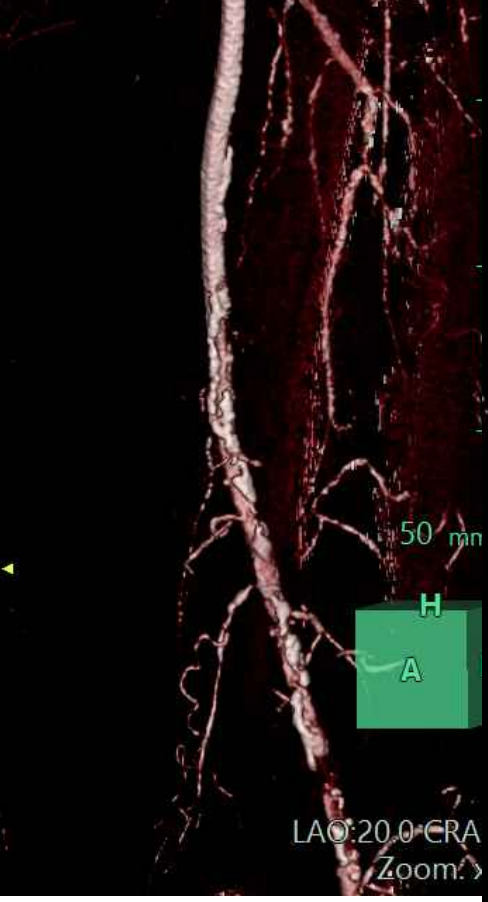
		Infrainguinal GLASS stage (I-III)		
FP Grade	4	III	III	III
	3	II	II	X
	2	I	II	II
	1	I	I	II
	0	NA	I	I
		0	1	2
				IP Grade

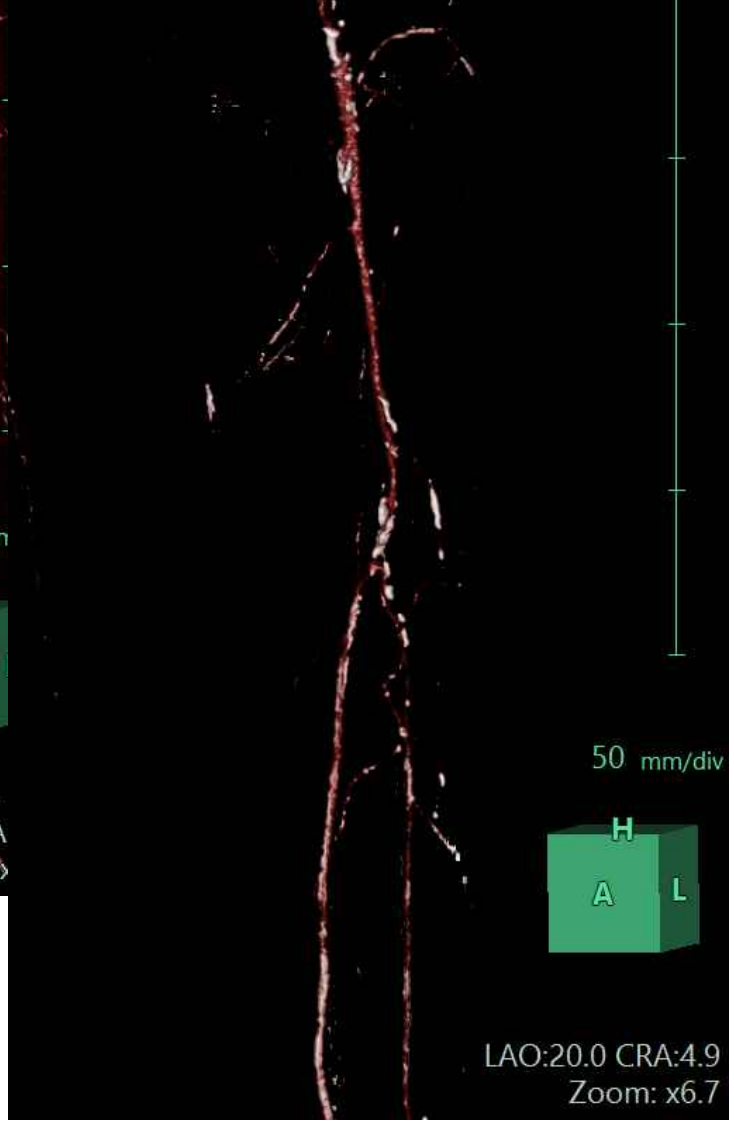
NA, Not applicable.
After selection of the target arterial path (TAP), the segmental femoropopliteal (*FP*) and infrapopliteal (*IP*) grades are d
angiographic images. Using the table, the combination of FP and IP grades is assigned to GLASS stages I to III, wh
complexity (low, intermediate, and high) of revascularization.

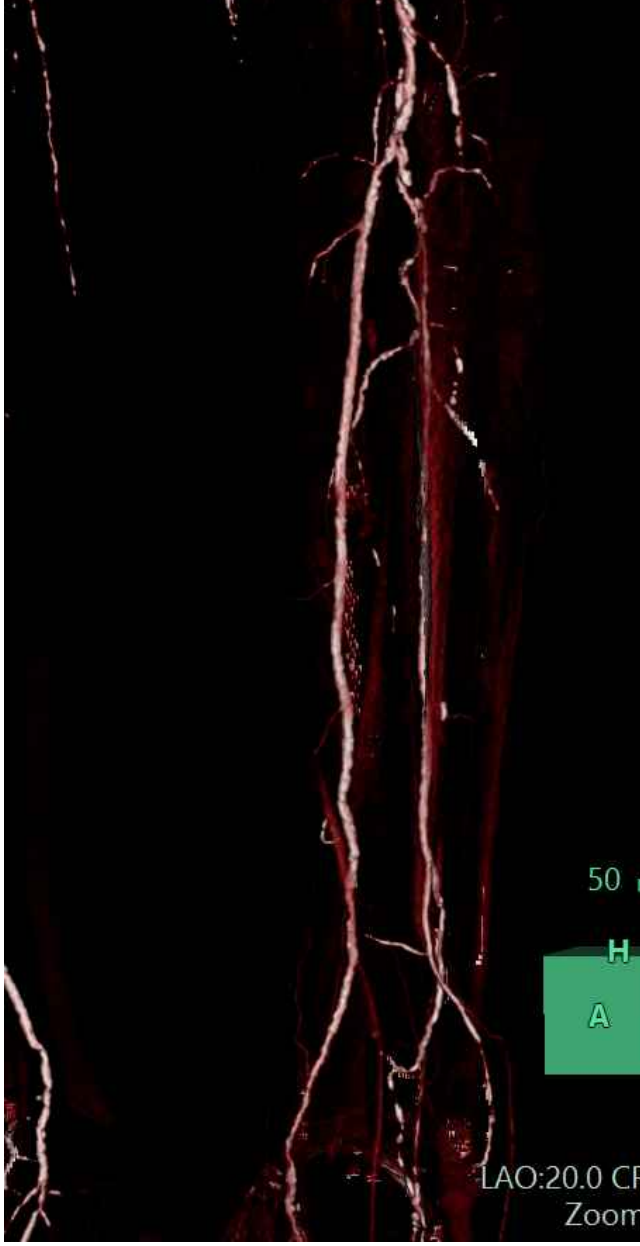
Rivascolarizzazione suggerita dall'integrazione del GLASS stage e WIfI stage

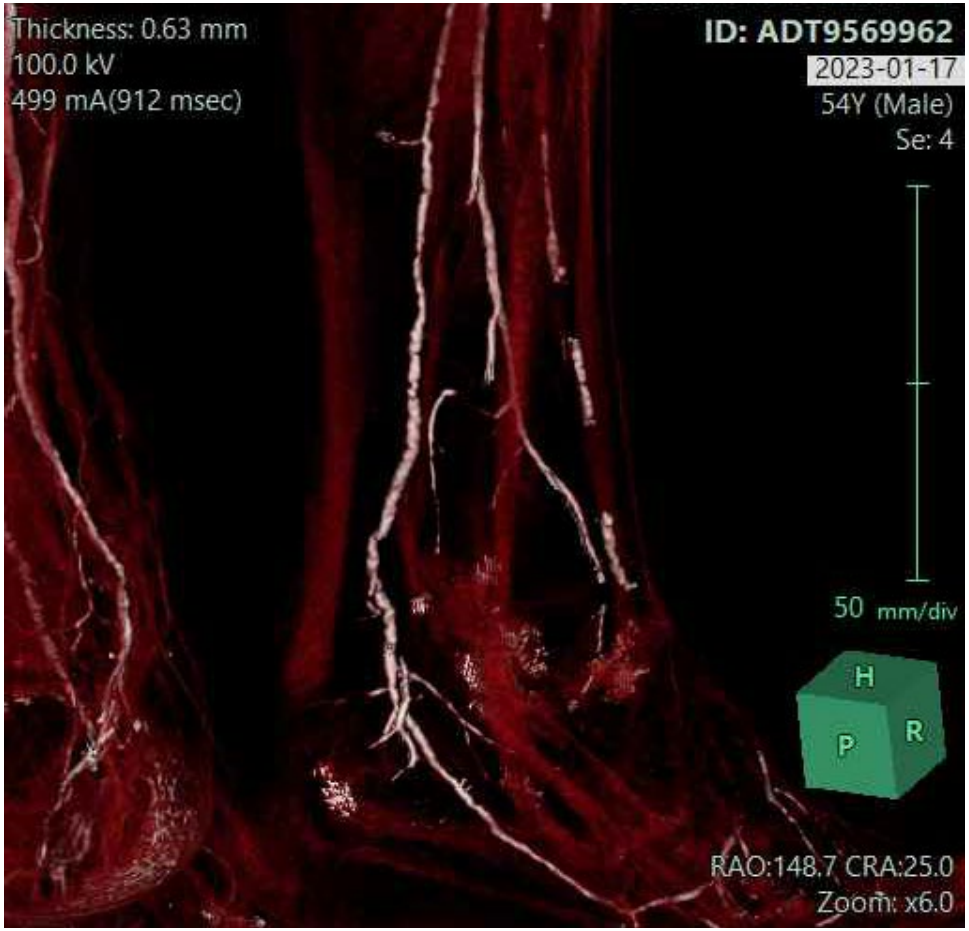


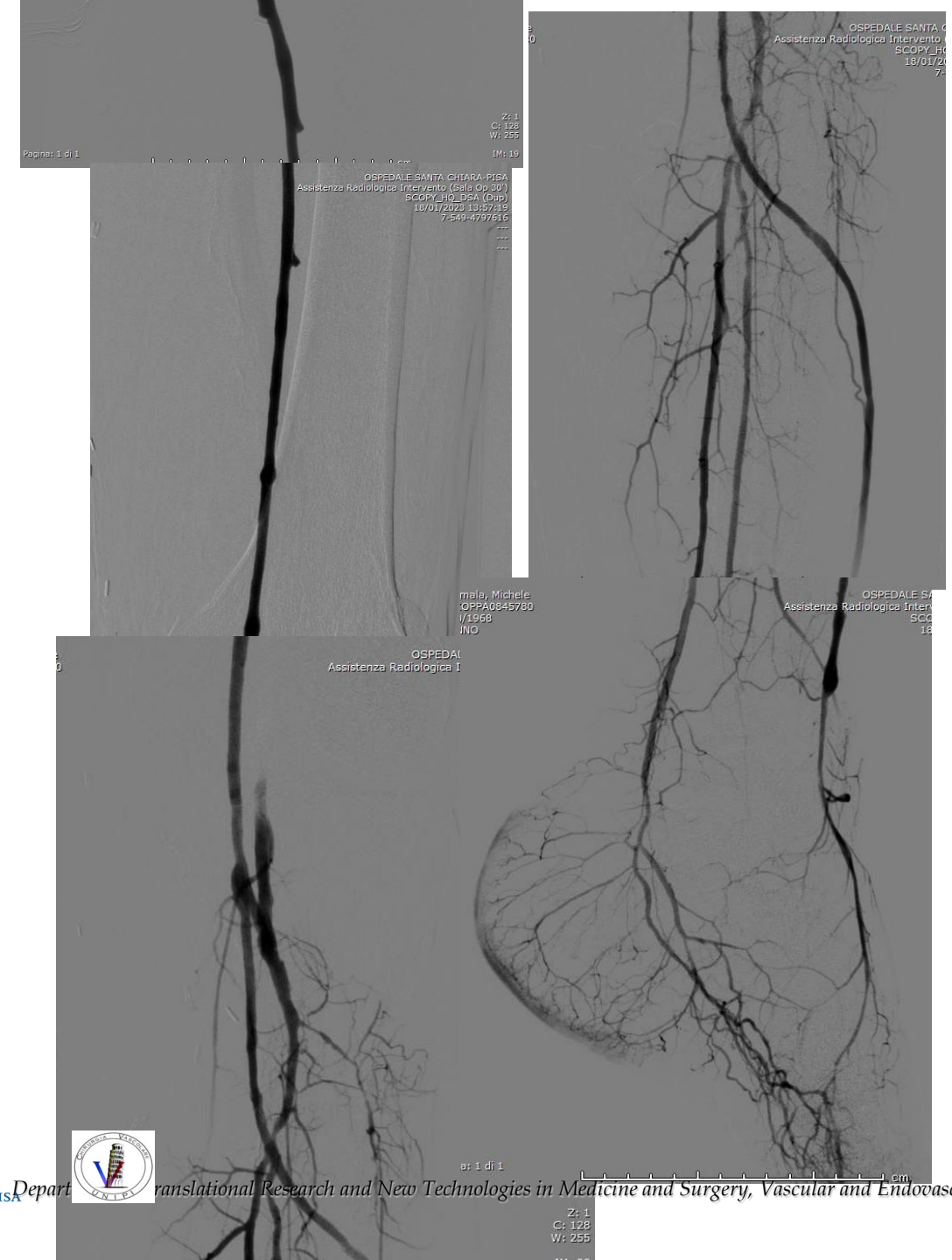



50 mn
H
A
LAO:20.0 CRA
Zoom:


50 mm/div
H
A
L
LAO:20.0 CRA:4.9
Zoom: x6.7


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H
A
LAO:20.0 CR
Zoom

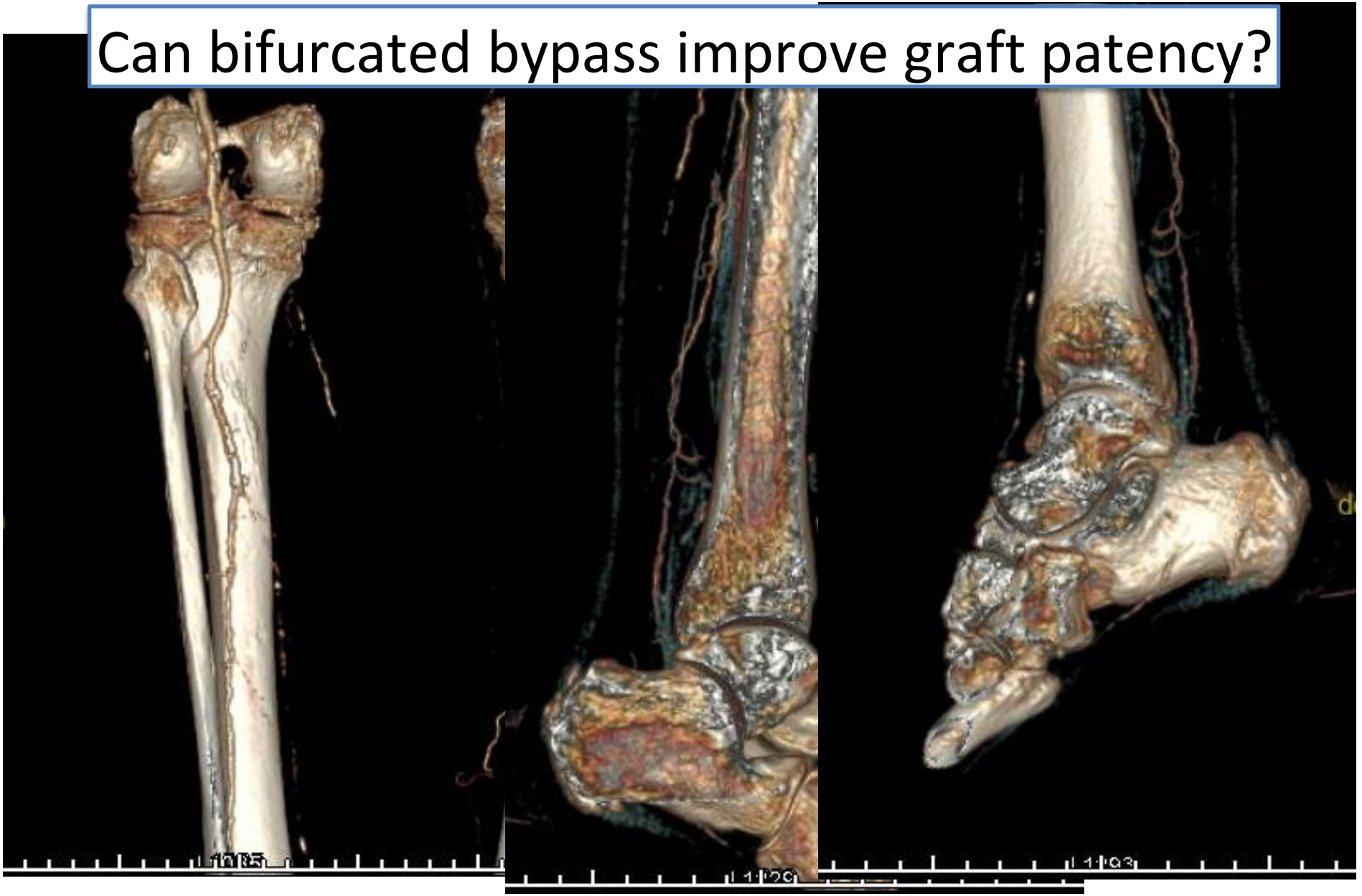

Thickness: 0.63 mm
100.0 kV
499 mA(912 msec)
ID: ADT9569962
2023-01-17
54Y (Male)
Se: 4
50 mm/div
H
P
R
RAO:148.7 CRA:25.0
Zoom: x6.0


OSPEDALE SANTA CHIARA-PISA
Assistenza Radiologica Intervento (Sala Op 30')
SCOPY_HQ_DSA (Dup)
18/01/2023 13:57:19
7-549-4797616
OSPEDALE SANTA
Assistenza Radiologica Intervento
SCOPY_HQ
18/01/20
OSPEDALE SA
Assistenza Radiologica Inter
SCO
18
OSPEDAL
Assistenza Radiologica I
Pagina: 1 di 1
IM: 19
Z: 1
C: 128
W: 255
cm



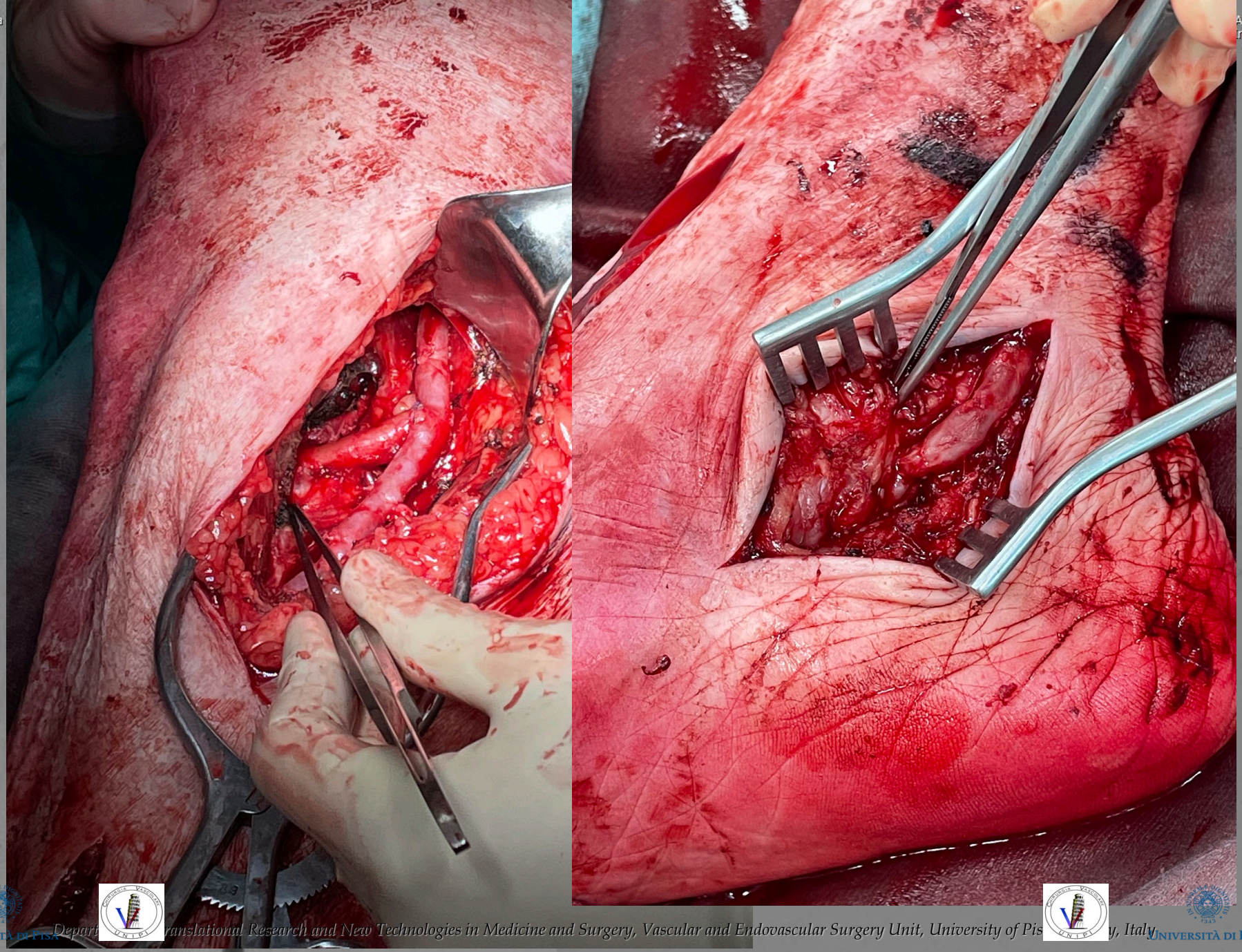


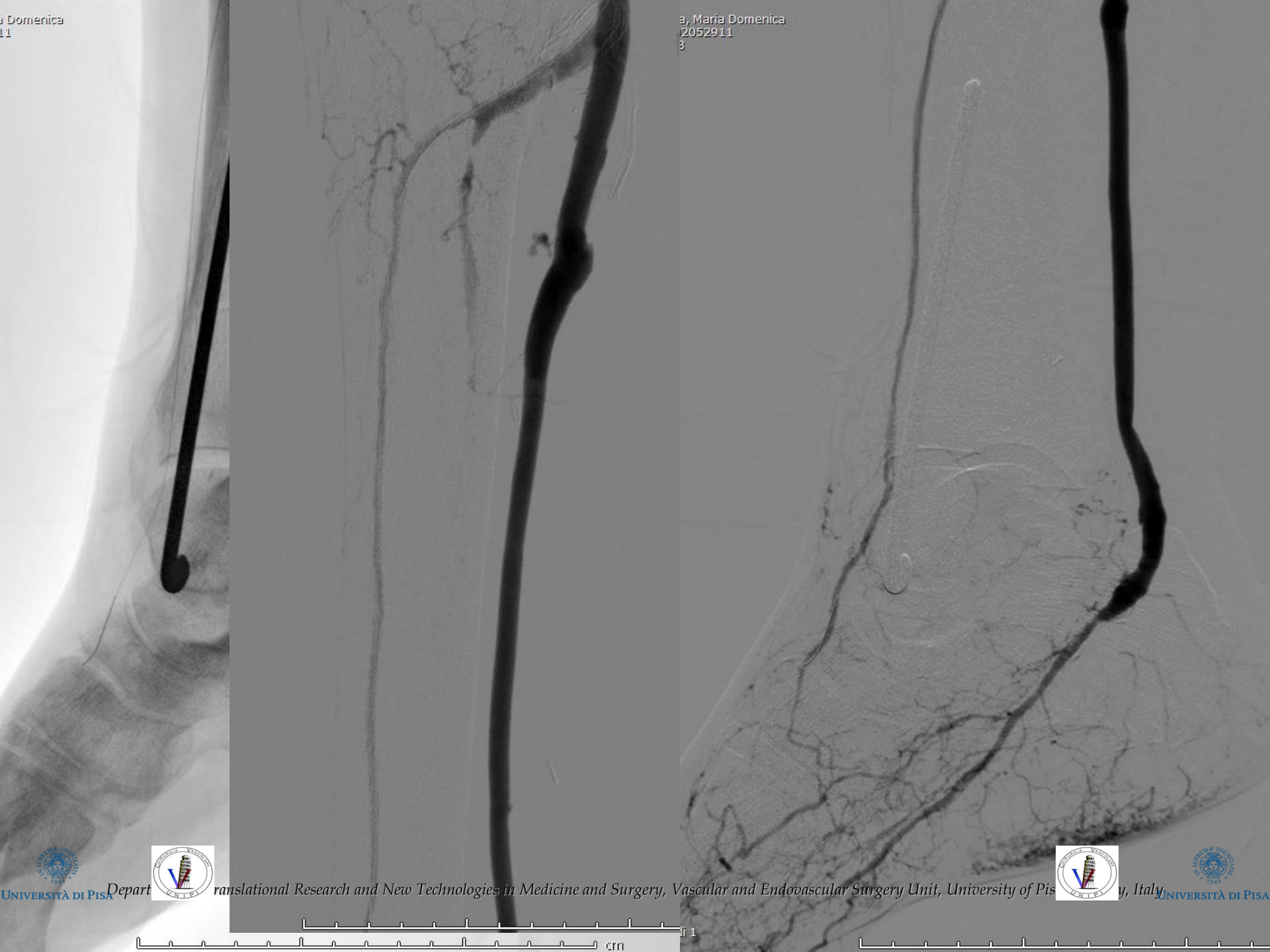
Can bifurcated bypass improve graft patency?

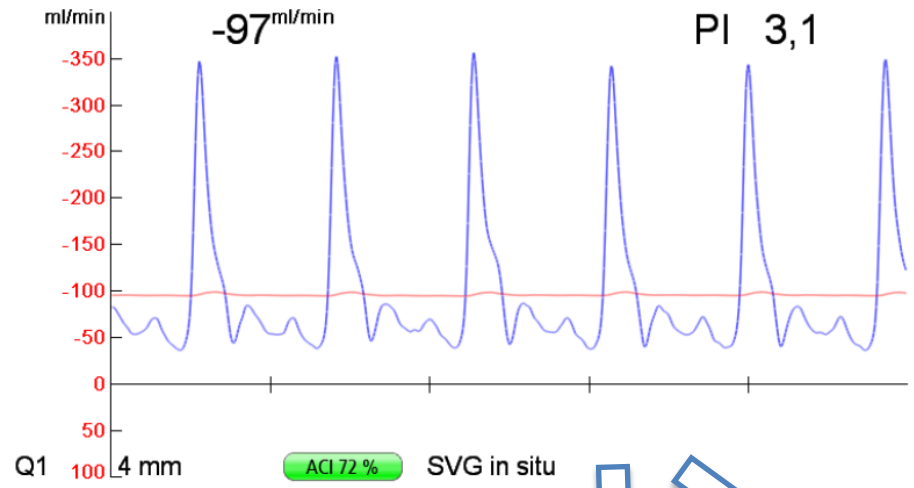


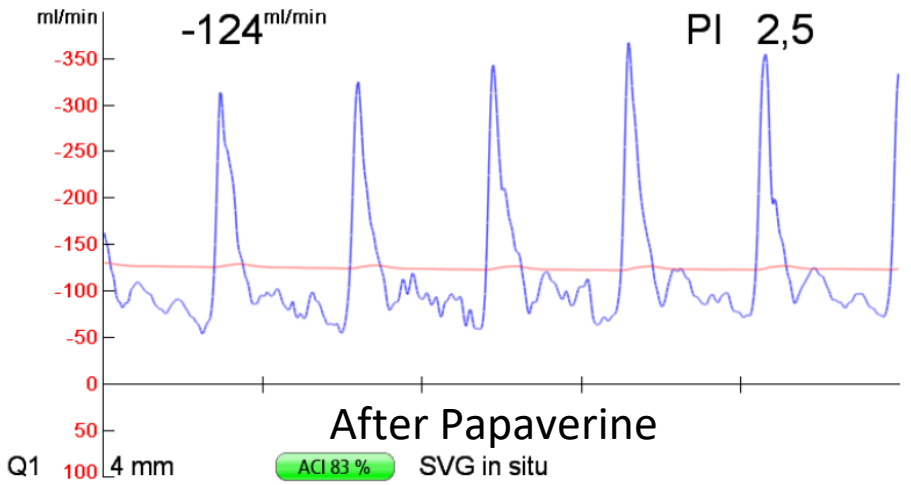


Female 80 yrs
Diabetes
Failed previous endo foot revasc.
WIfI H Rutherford 5




a Domenica
11
a, Maria Domenica
2052911
3
cm

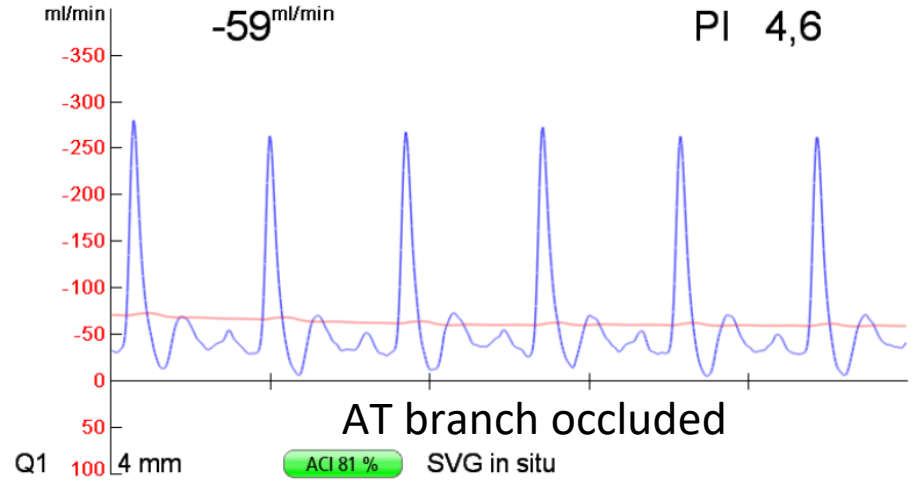




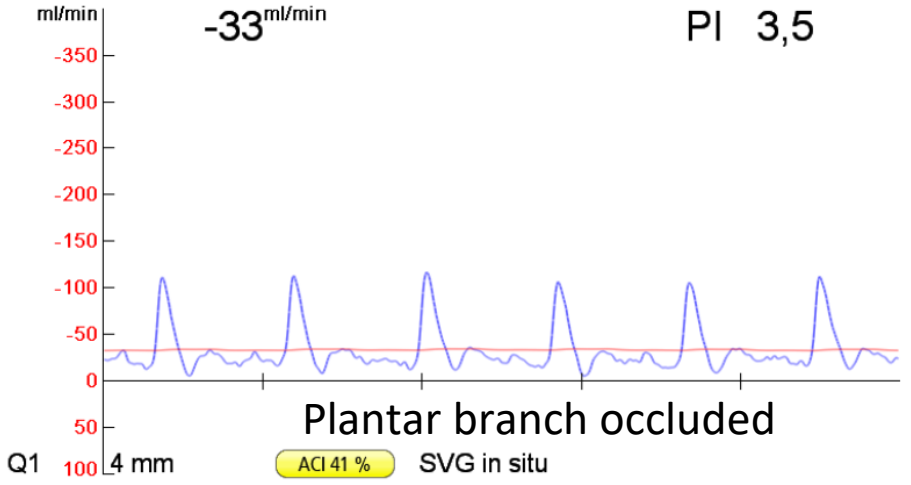
After Papaverine

09/02/2022 16:25:01 5s

09/02/2022 16:25:47 5s



AT branch occluded



Plantar branch occluded

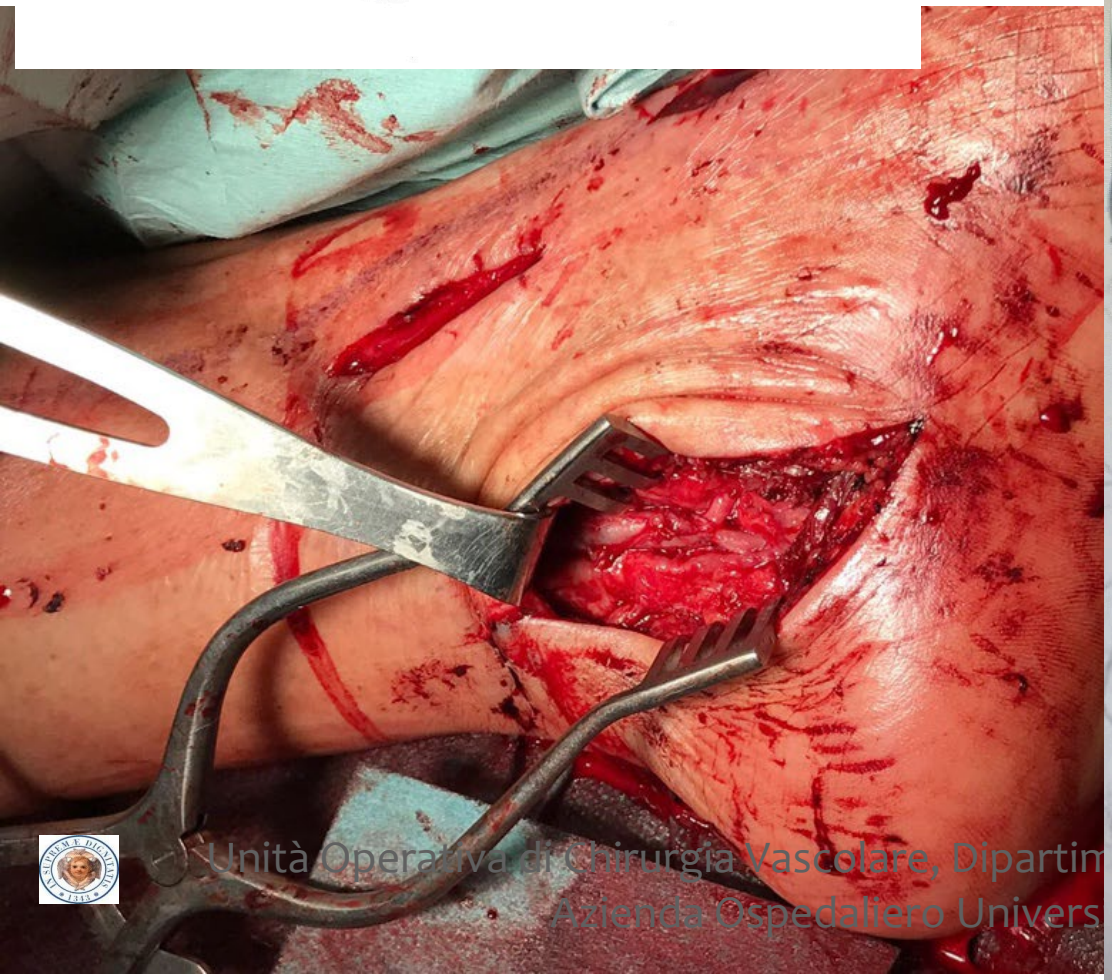


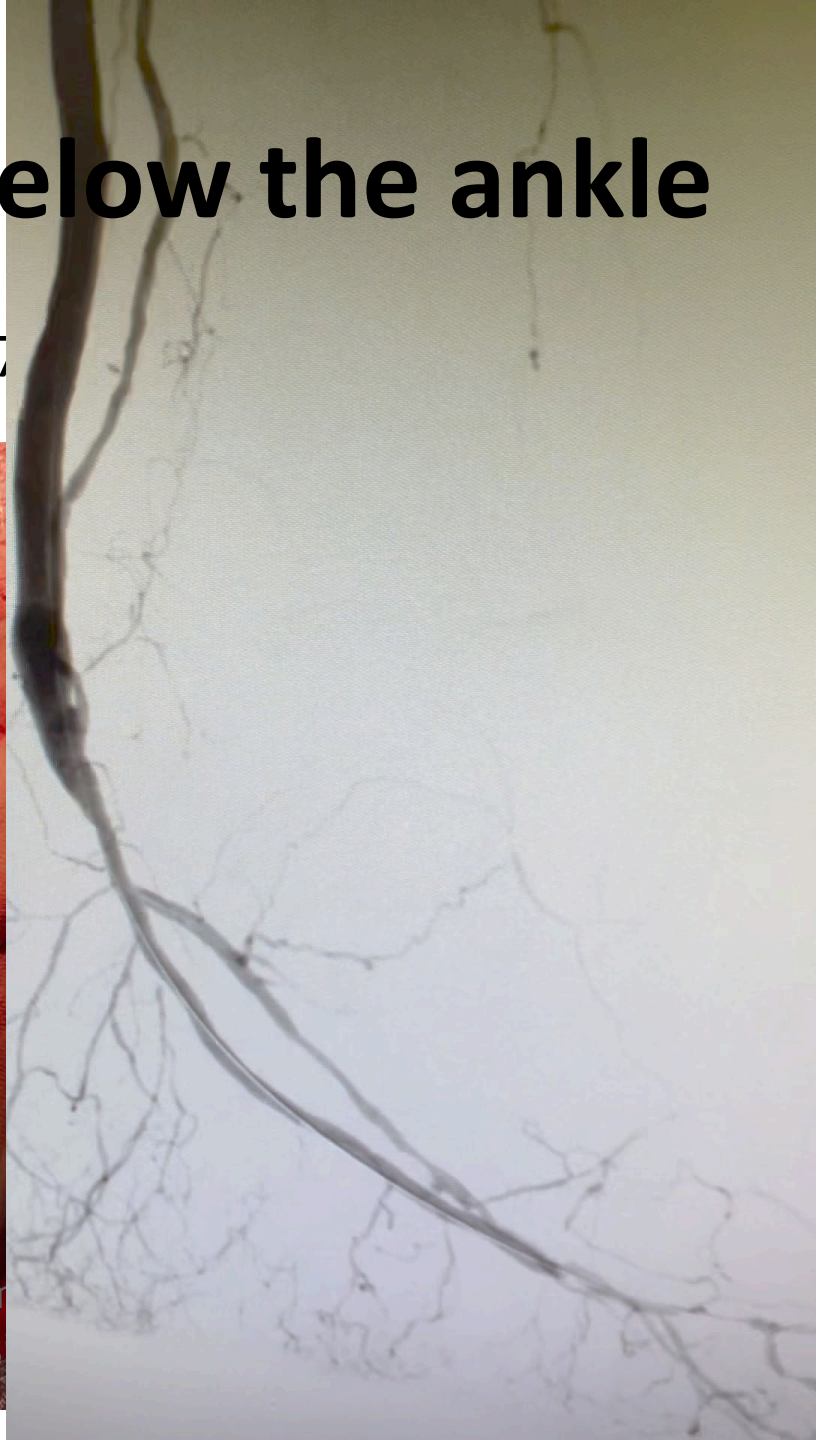


NO BTK arteries

2 Bypass landing below the ankle

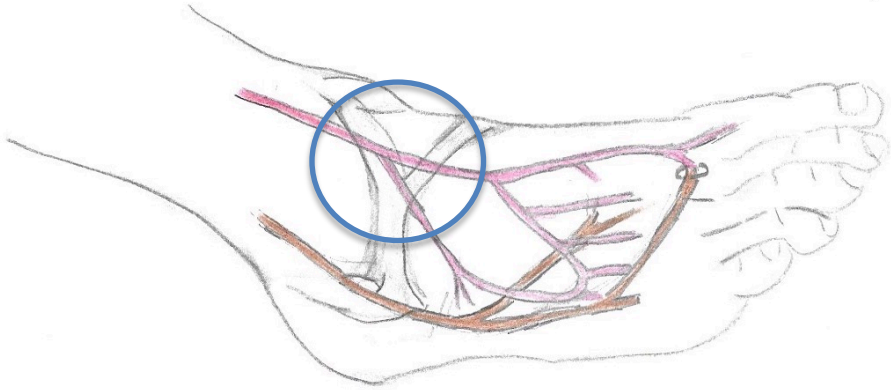
- Vascular Foot Surgery: **86** cases (67

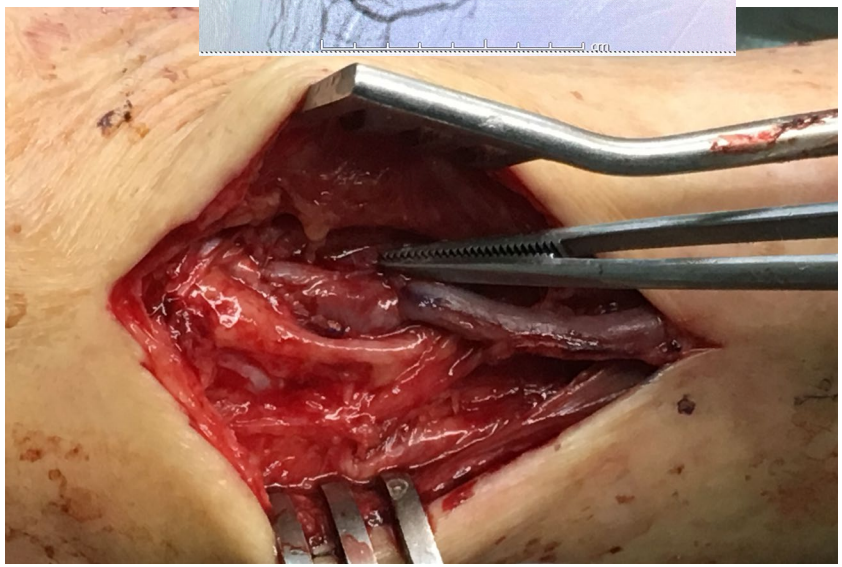


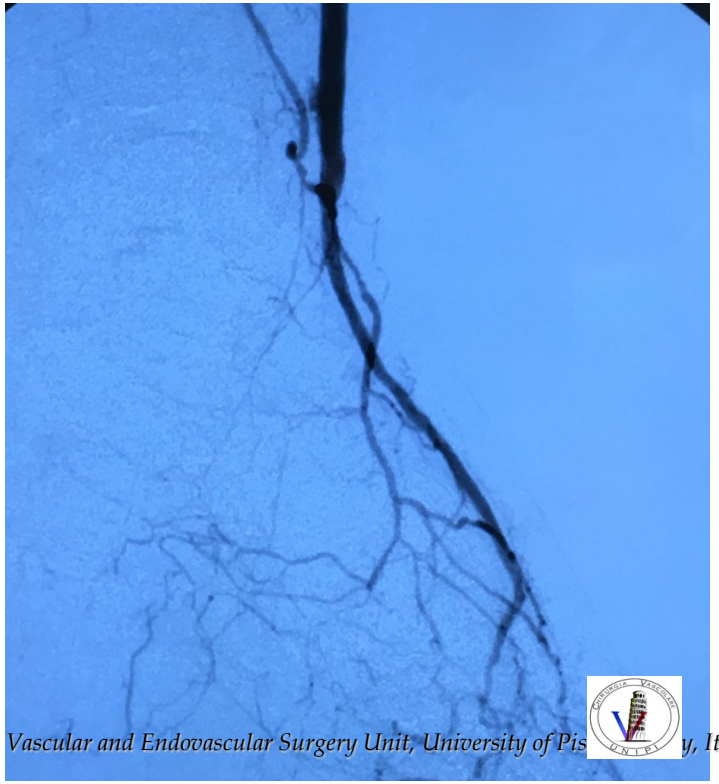


Dorsal Artery Bypass

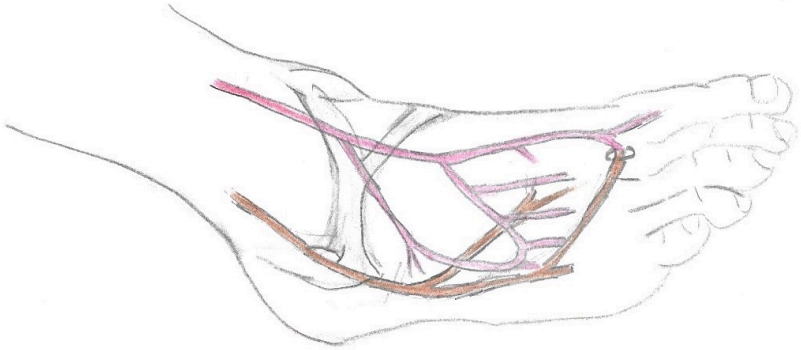


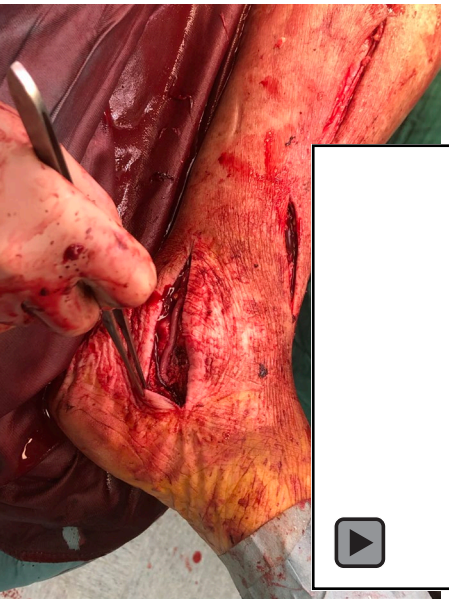




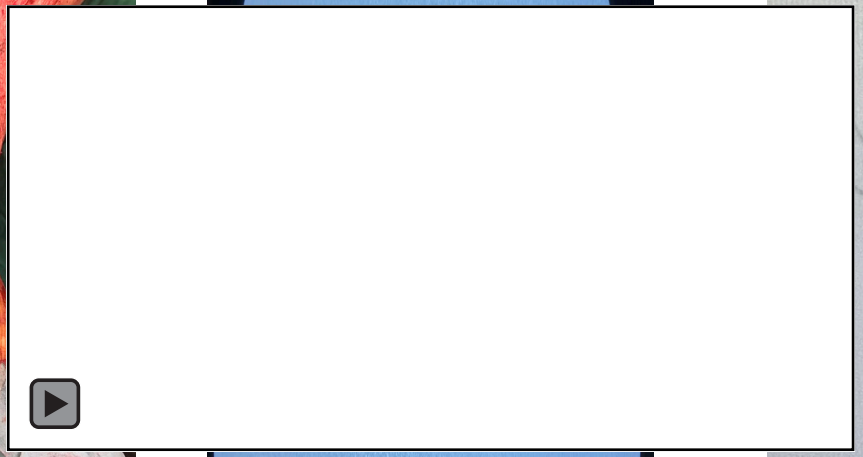


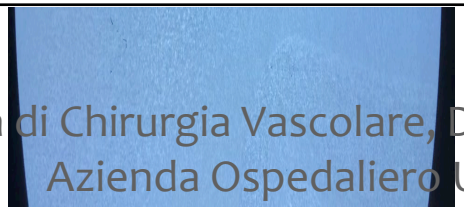
Medial Plantar Bypass







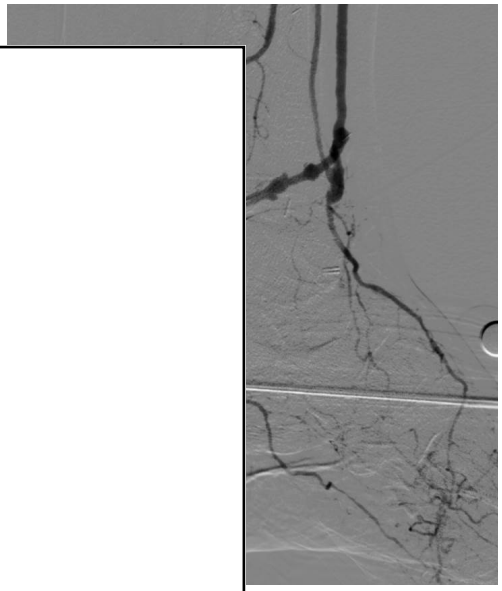


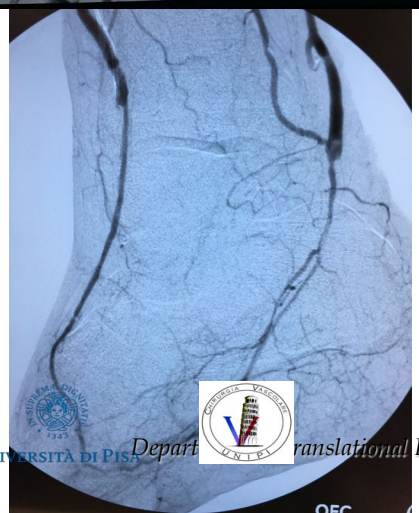


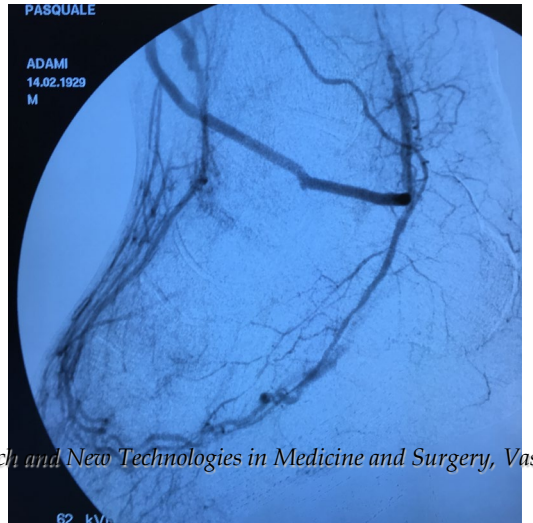


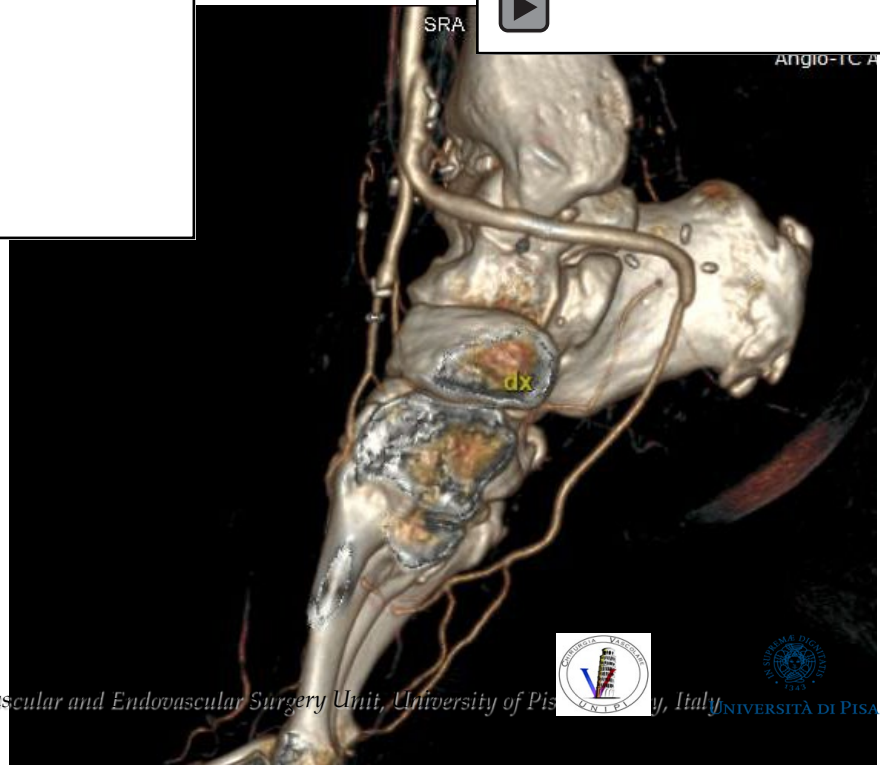
Total Foot Revascularization





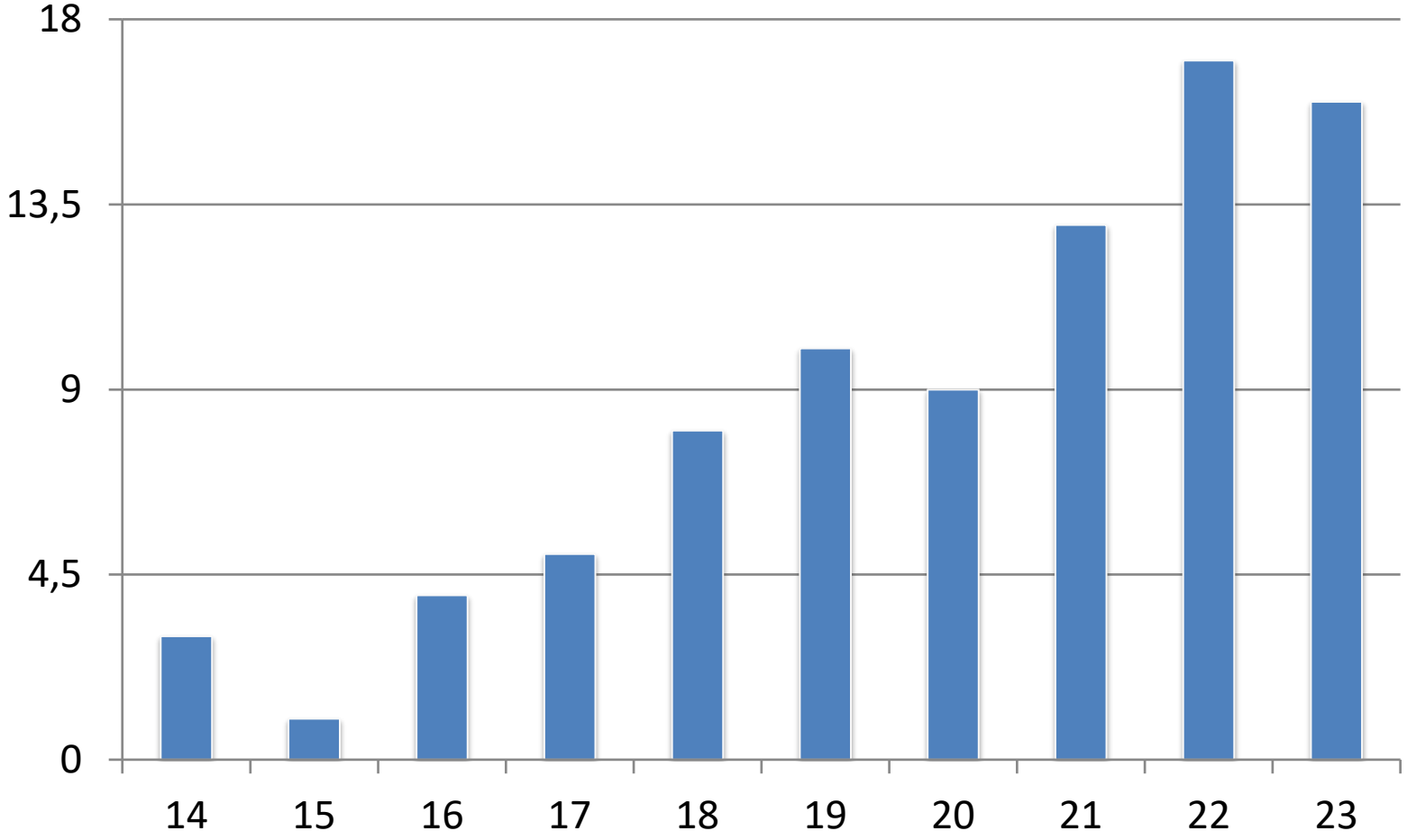






Below Ankle Bypass 86

Mean follow up 17,6 months Overall Amputation rate 7 (8.1%)



Below the ankle bypass

	N°	Pat.I/ass. 1 yr	2 yr	3 yr	5yr	Limb Salvage 1yr	2 yr	3yr	5yr
Asher 88	24	74	67						
Andros 88	224		72/92	80/81					
Shah 93	270			79	73				
Davidson 93	75			79/86.3				87.5	
Schneider 93	53			58/82			92		
Quinones-Bald.93	46		72				89		
Bergamini 94	175		70/77				74		
Eckstein 94	56	65/82	55/73			77	71		66
Braches 00	24		70				80		
Kalra 01	256				58/71				78
Friedman 02	22		71				82		
Pomposelli 03	1032				37.7/41.7				57.7
Good 11	24	63.3/74.6				81.8			
Jorgensen 20	99	64.8/72.1				79.9			60.3
Avg	2380	66.7/76.3	69.1/80.3	74/83.1	56.2/56.3	79.5	81.3		65.5

How to plan a below the ankle by pass from a technical point of view

Arterial Source

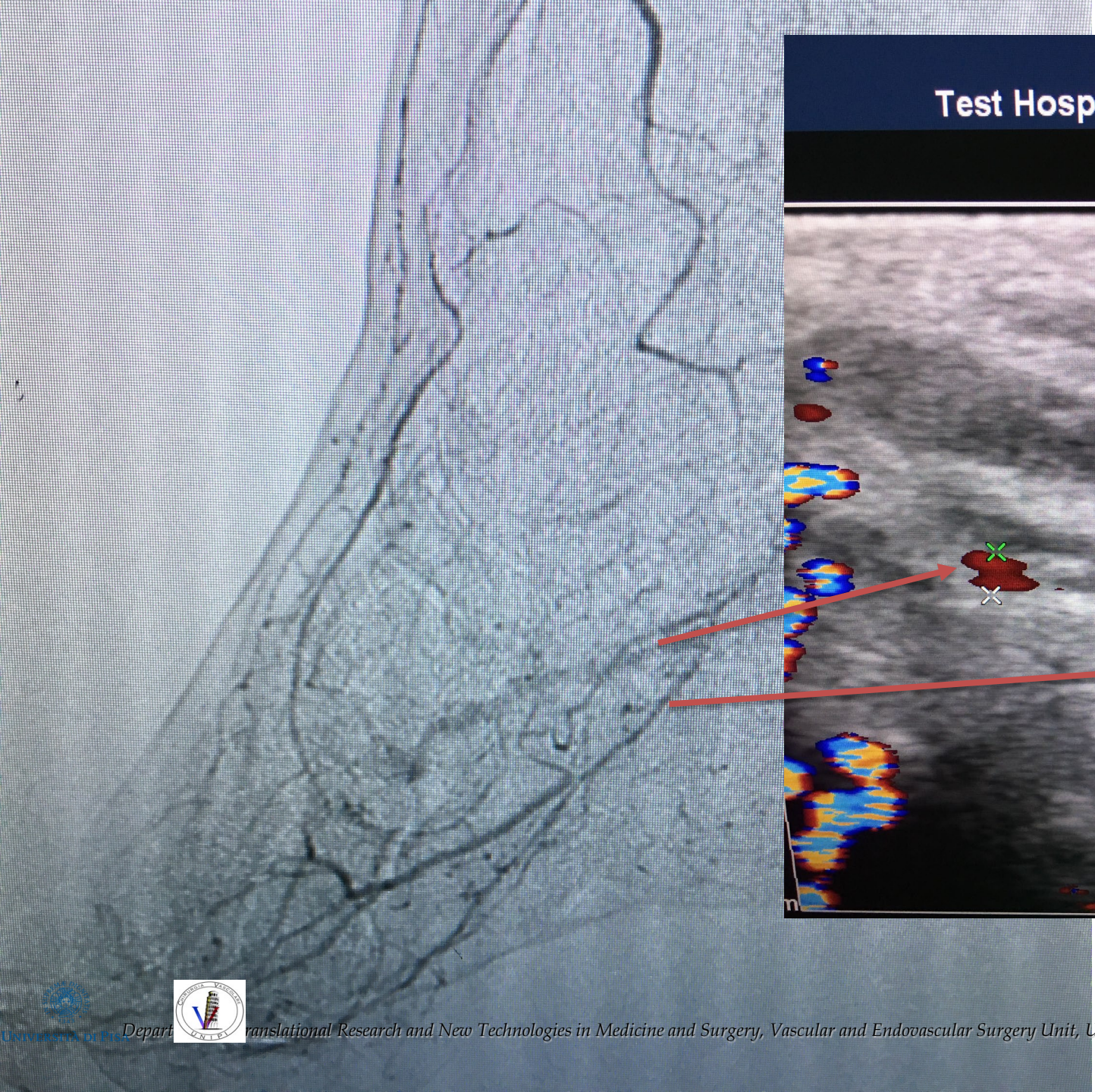
Vein heritage

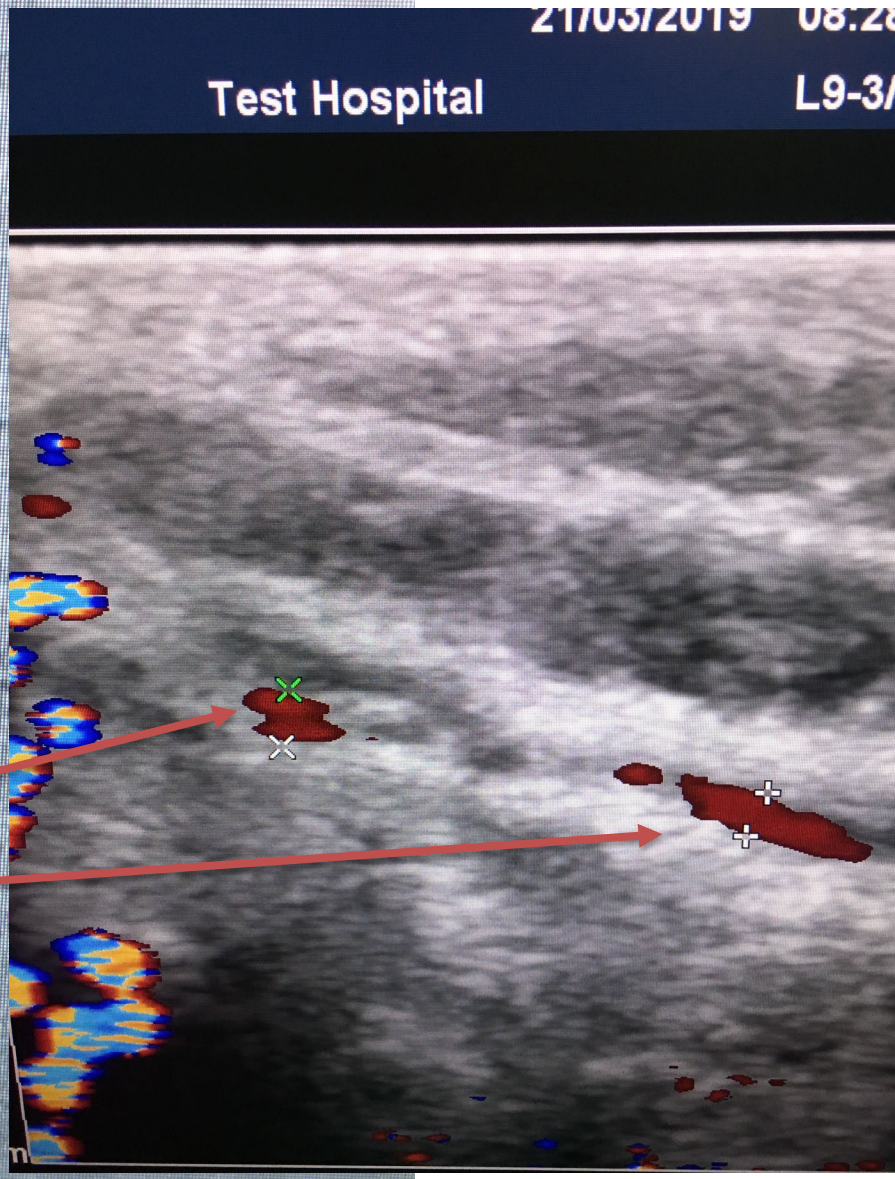
Which Imaging?

DopplerUS

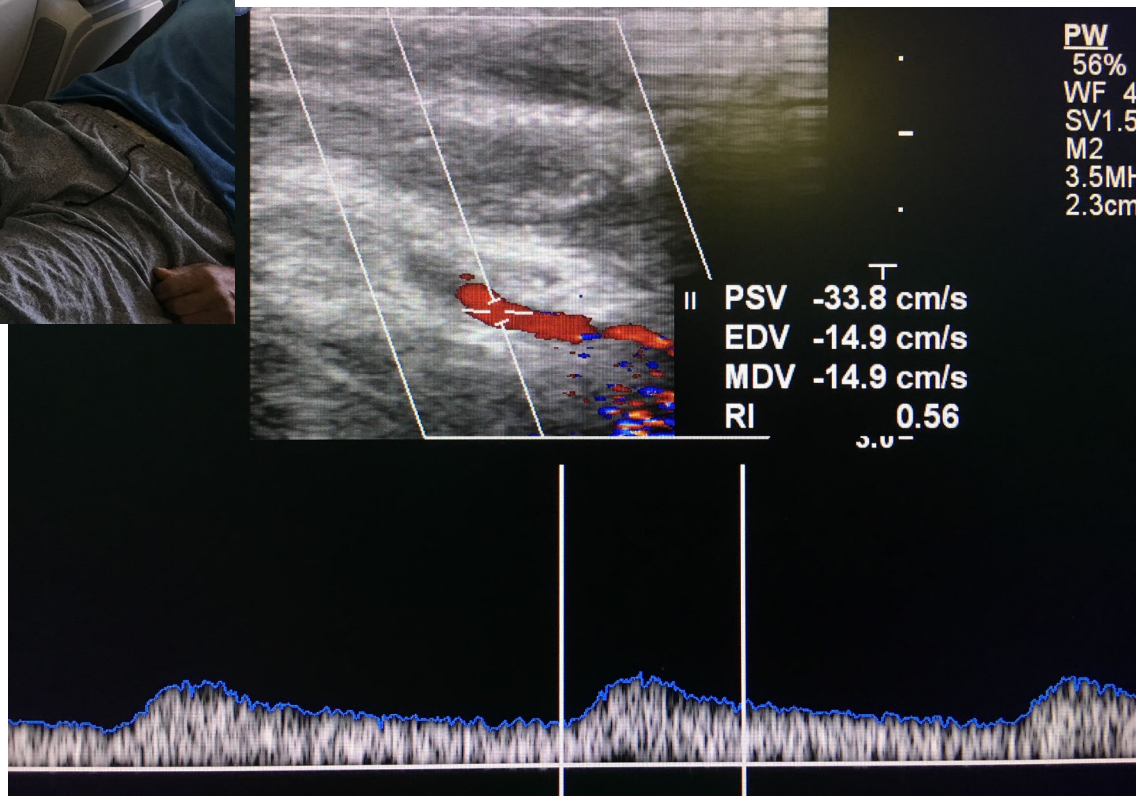
Landing Zones

Plantar	**Dorsal**
Lateral	**Tarsal**
Medial	**Dorsal End**

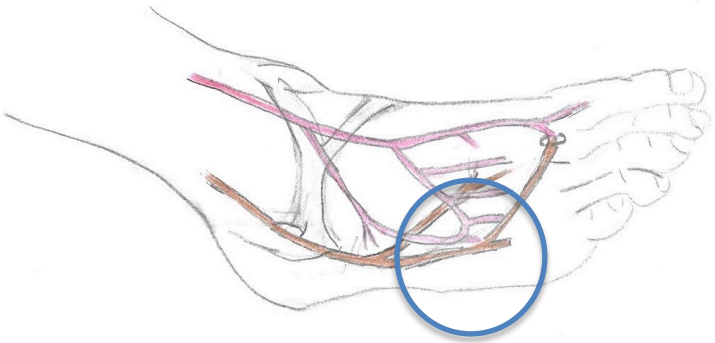


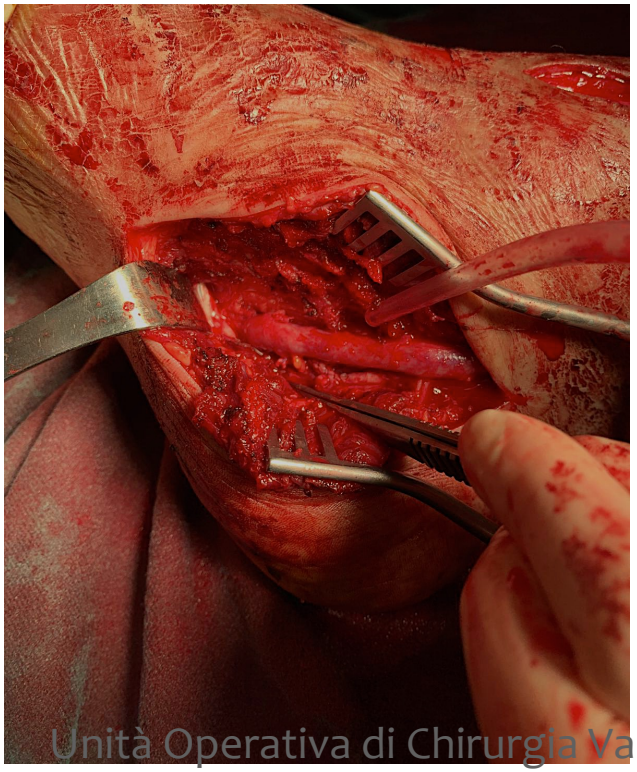

21/03/2019
Test Hospital
L9-3/

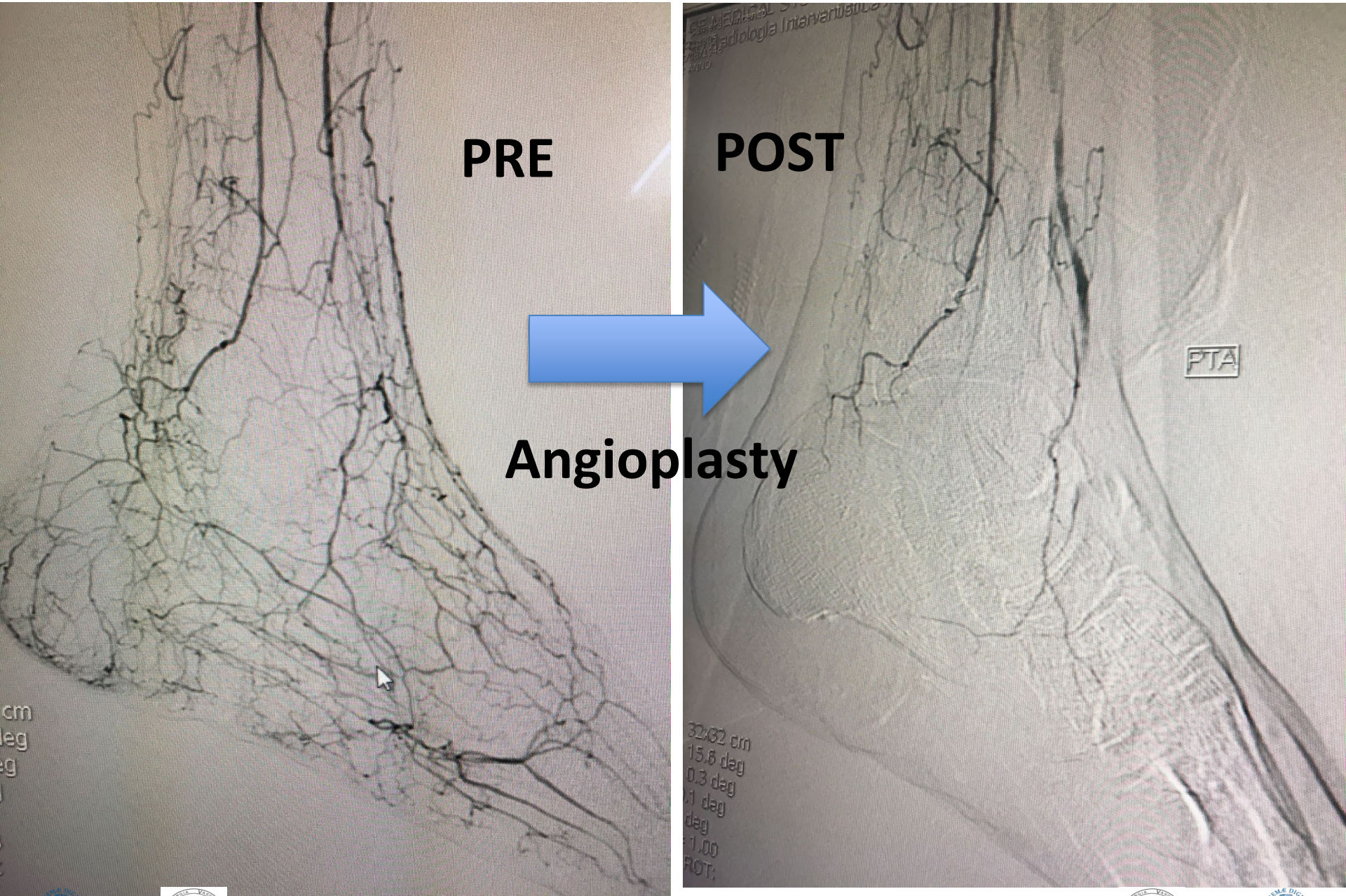



PW
56%
WF 4
SV1.5
M2
3.5MH
2.3cm
PSV -33.8 cm/s
EDV -14.9 cm/s
MDV -14.9 cm/s
RI 0.56

Lateral Plantar Bypass

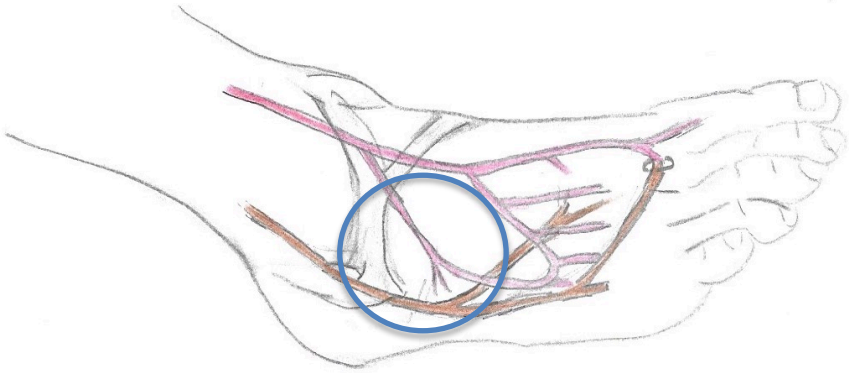




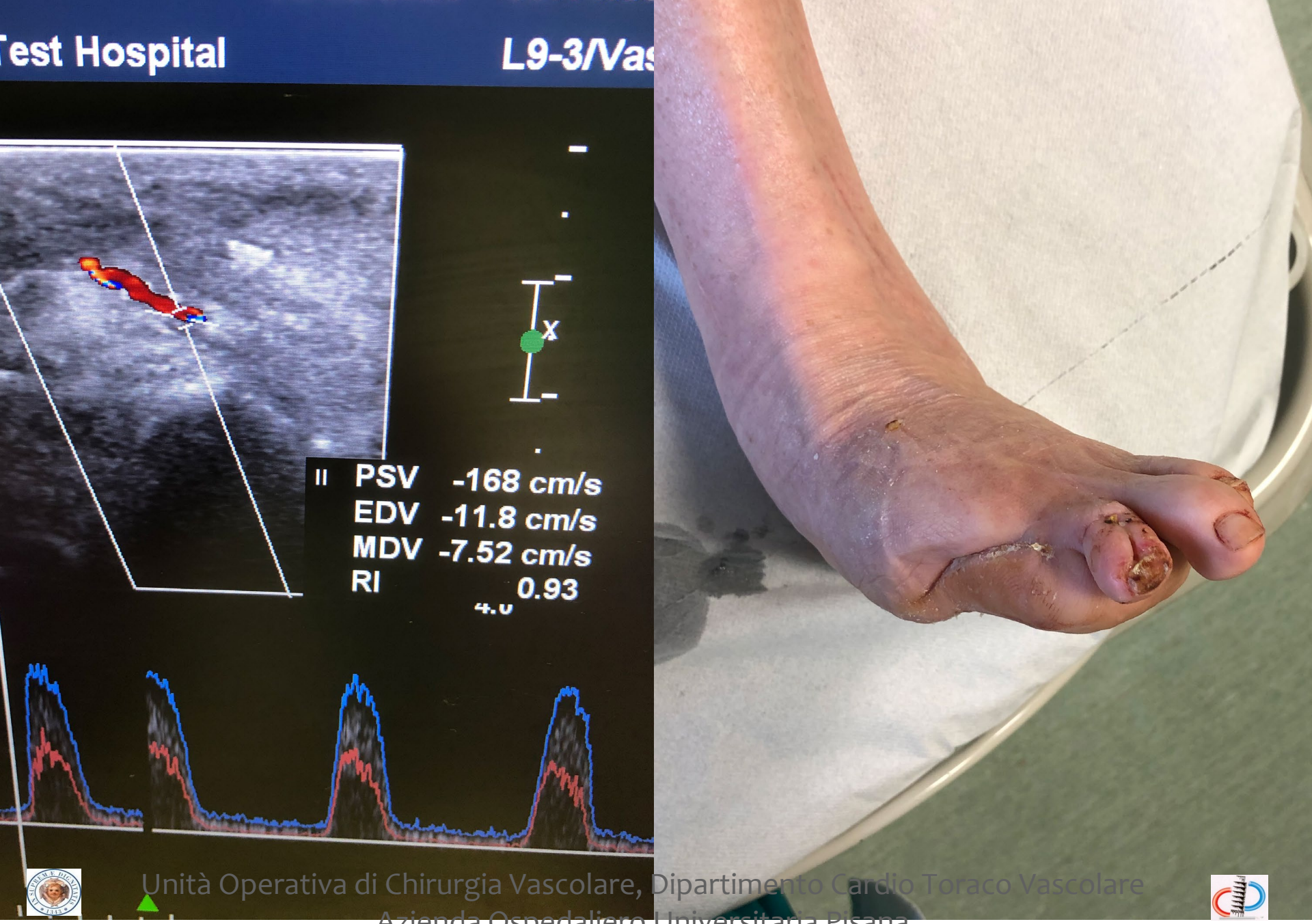

PRE
POST
Angioplasty
PTA



Lateral Tarsal Bypass

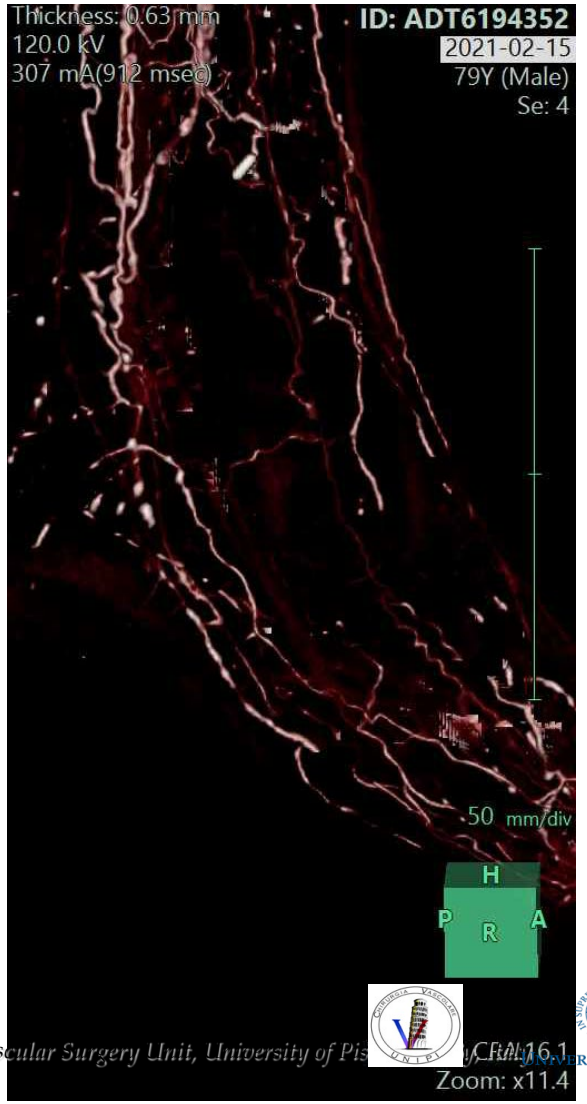




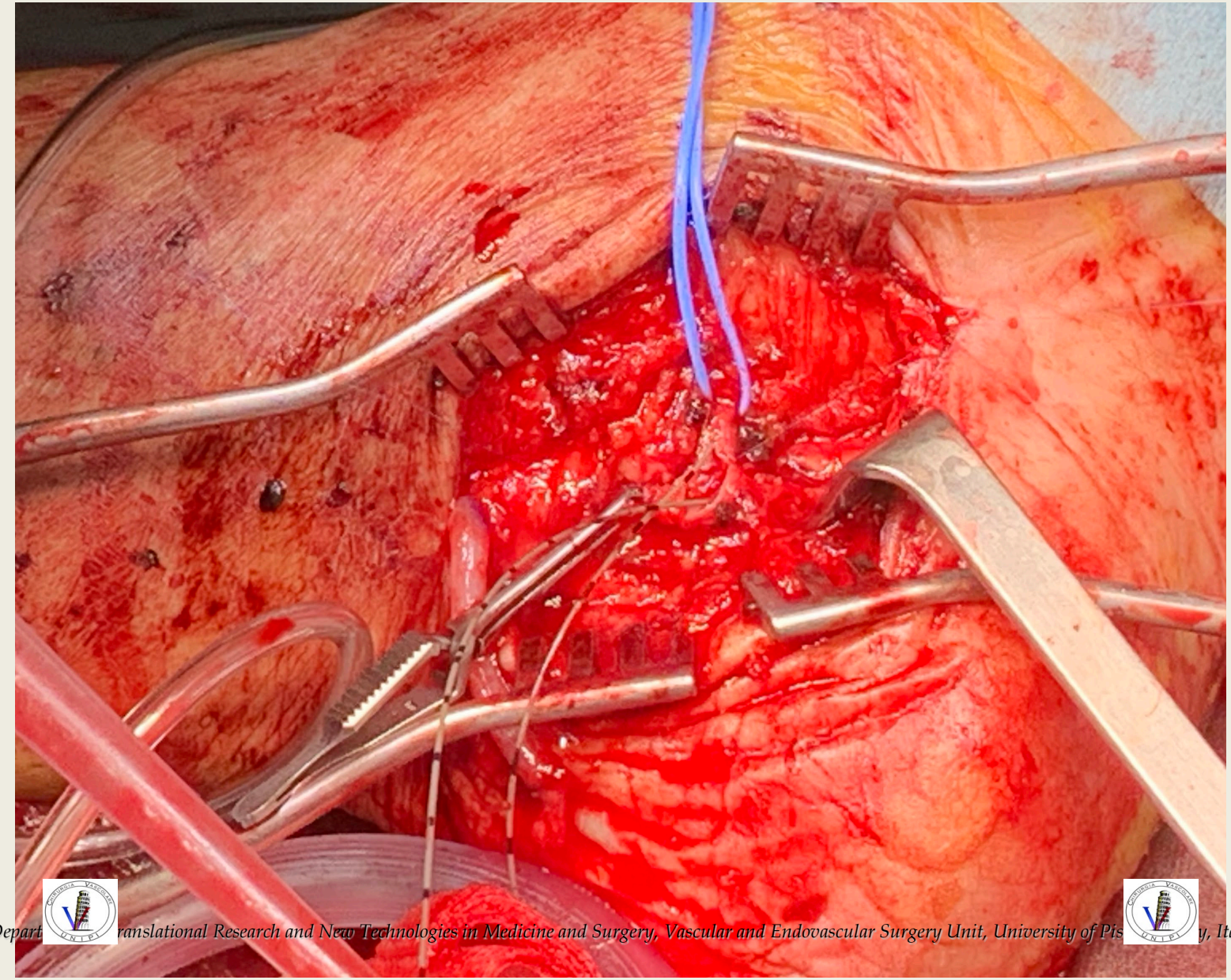

Test Hospital
L9-3/Vas
PSV -168 cm/s
EDV -11.8 cm/s
MDV -7.52 cm/s
RI 0.93

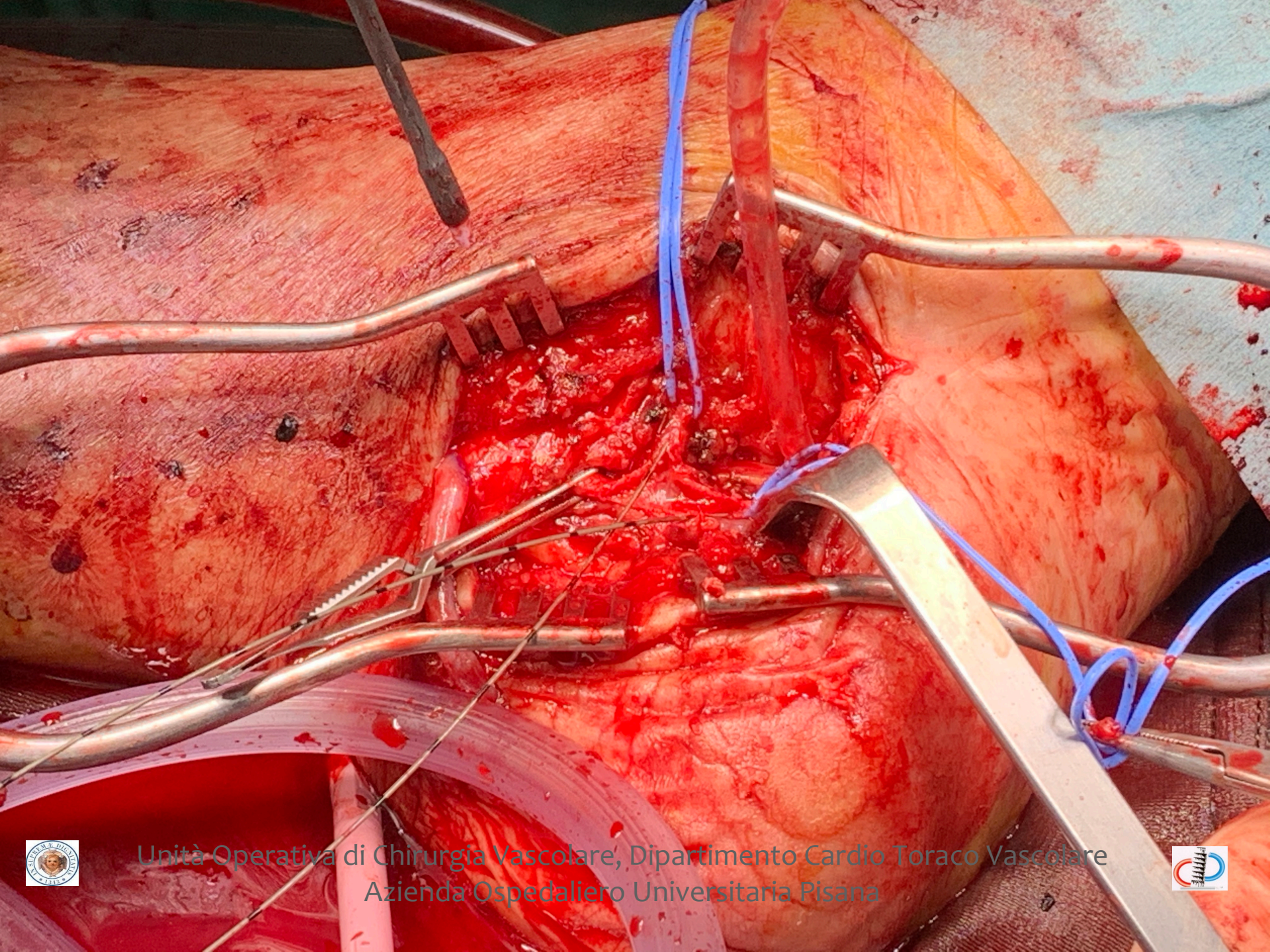
Desert Foot

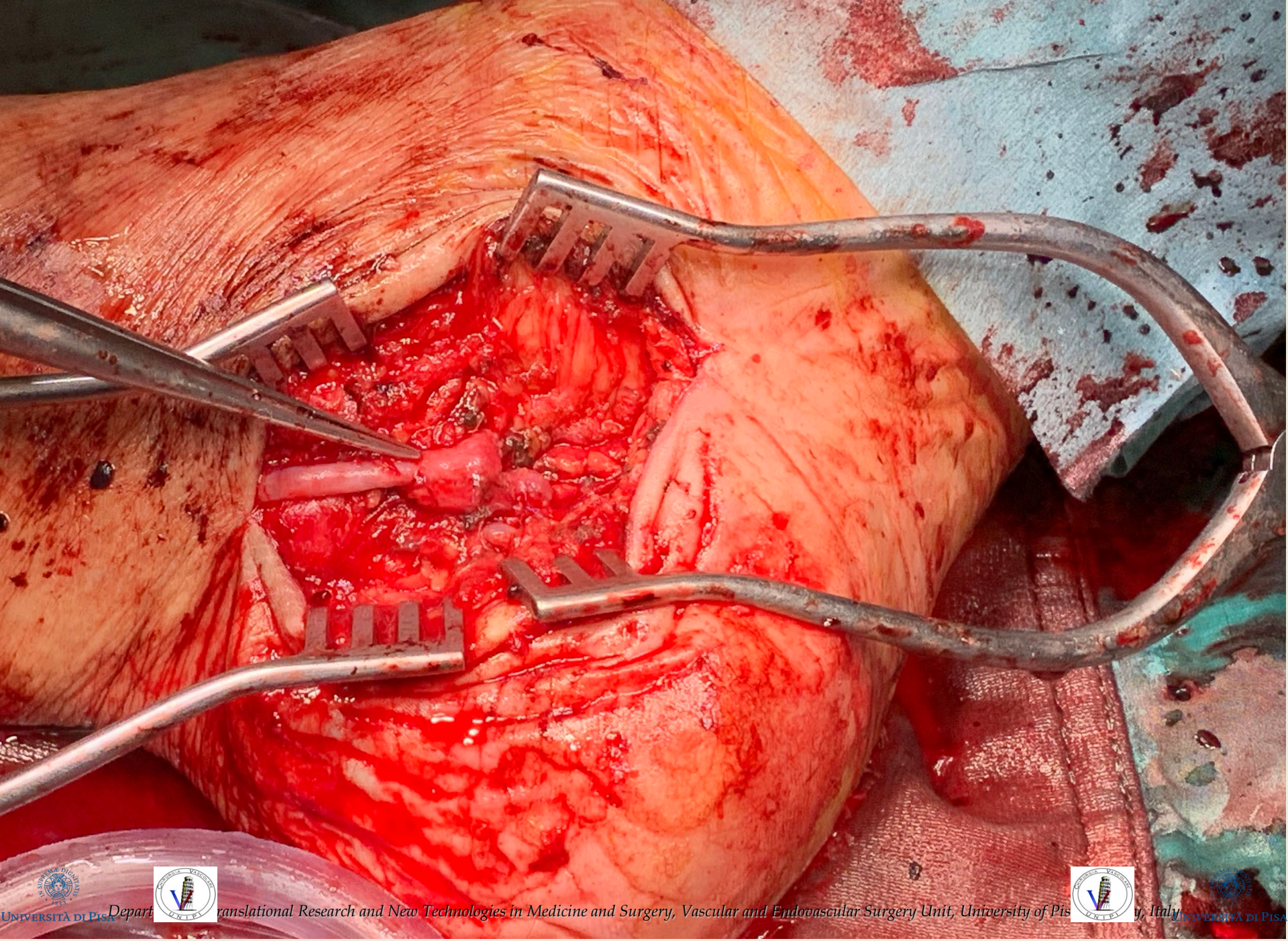
Desert Foot?
Foot Endoarterectomy



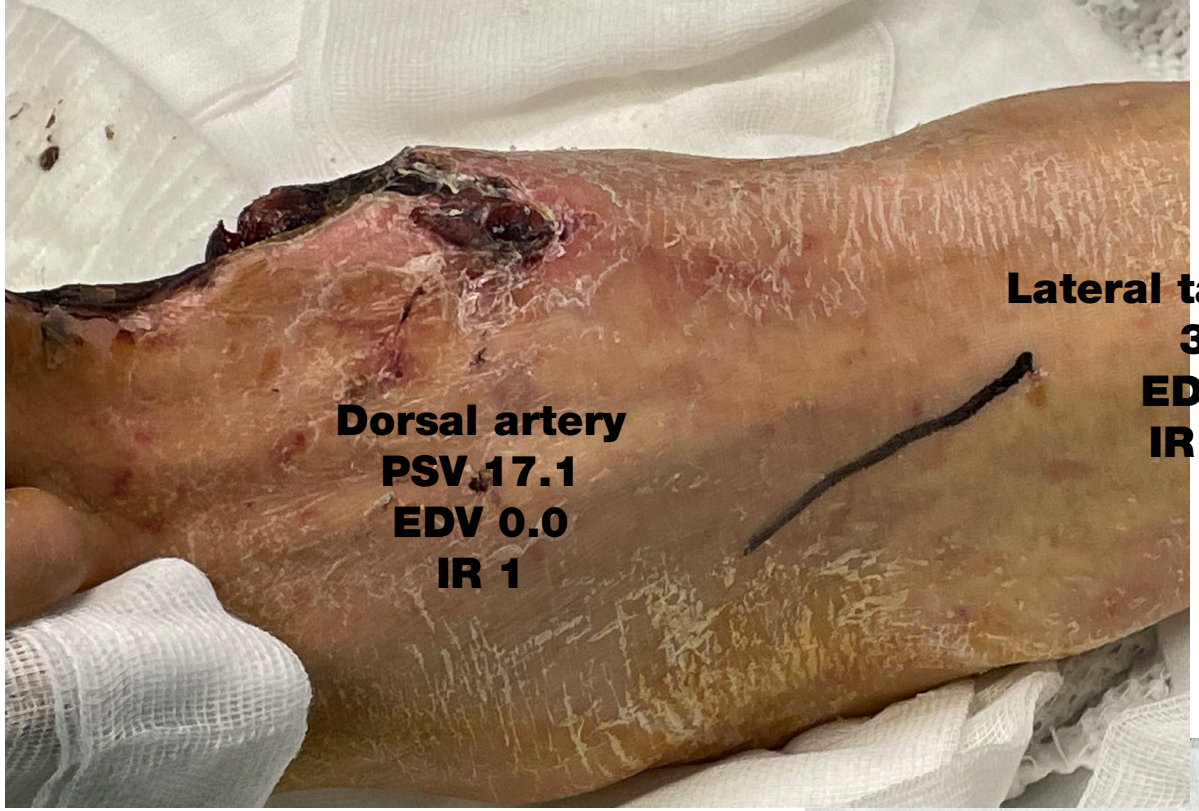
Desert Foot?
Foot Endoarterectomy



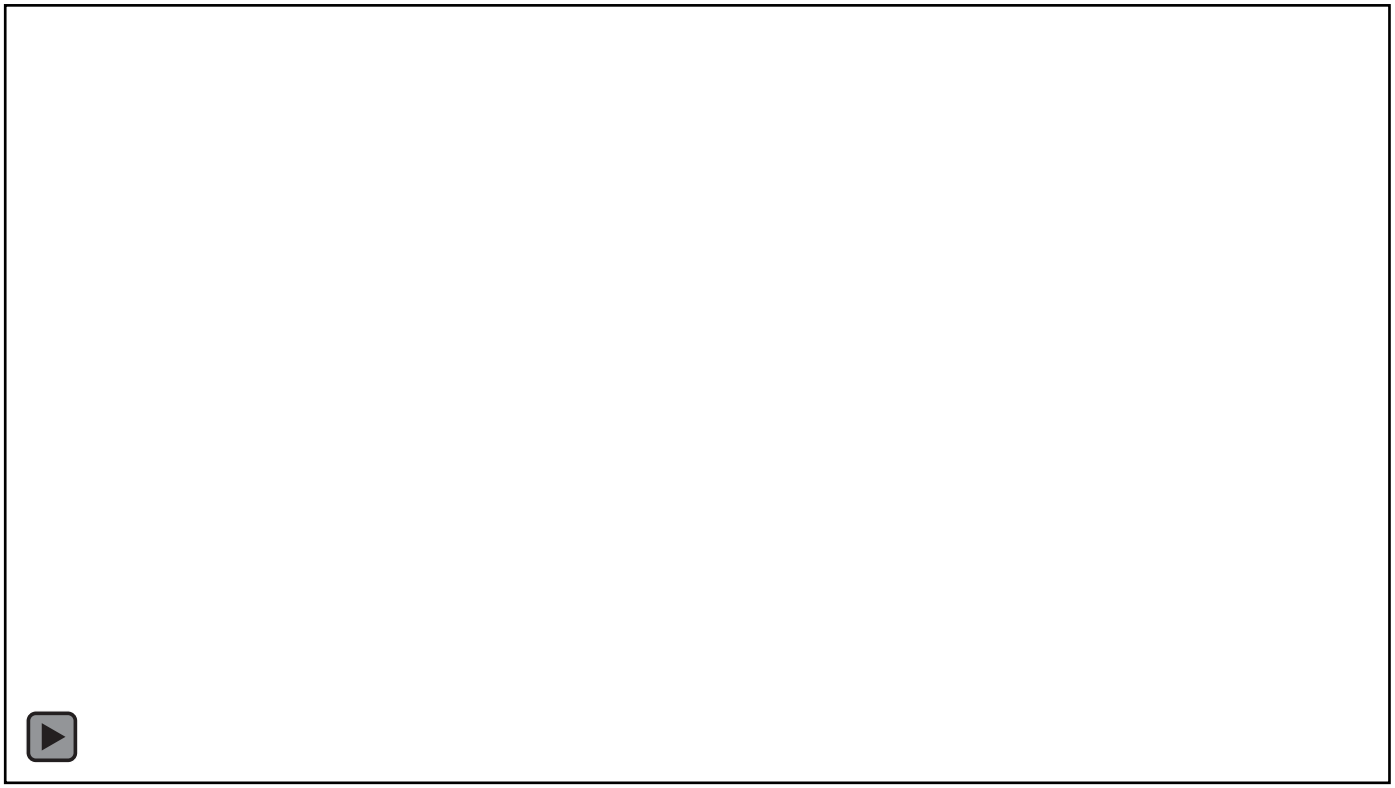







Dorsal artery
PSV 17.1
EDV 0.0
IR 1
Lateral tarsal artery
38.2
EDV 5.8
IR 0.85


Plantar Lateral artery
PSV 85.3
0.9



"No-option" anatomy. The majority of CLTI patients are anatomically suitable for revascularization, and establishing direct in-line flow to the foot is the primary technical goal. One important exception is ischemic rest pain, for which correction of inflow disease alone or treatment of FP disease even without continuous tibial runoff to the foot may provide relief of symptoms. This may also be the case in patients presenting with minor degrees of tissue loss (eg, WIfI stage 2). Thus, the definition of a no-option anatomic pattern of disease is dependent on clinical context. Lack of a target artery crossing the ankle and absence of a suitable pedal or plantar artery target (eg, GLASS P2 modifier) may be considered no-option disease patterns in patients with advanced CLTI (eg, WIfI stages 3 and 4). Angiography may occasionally fail to detect a patent distal artery target, and there are reports of successful tibial and pedal bypass grafting based on exploration of an artery identified on Doppler ultrasound examination that was not identified on contrast arteriography.[419,420] Careful selection and experienced surgical judgment are required before proceeding to surgery in such instances.

Journal of Vascular Surgery
June Supplement 2019

Conclusions
Surgical Revascularization:

- **Nowdays Surgery is more skill demanding**



Tecniche Chirurgiche per la Rivascolarizzazione degli Arti Inferiori

Soluzioni e Strategie Chirurgiche Avanzate

CORSO DI PERFEZIONAMENTO UNIVERSITARIO



Dipartimento Cardio Toraco Vascolare
Azienda Ospedaliero Universitaria Pisana

Direttore del Corso: Prof. Raffaella Berchiolli
Consiglio scientifico: Prof. Nicola Troisi; Dott. Daniele Adami

UNIVERSITÀ DI PISA

Seconda edizione

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