

Diabetic Foot Ulcer : Vascular Management

Practical Point in Holistic Diabetic Foot Care
3 March 2016

Supapong Arworn, MD

**Division of Vascular and Endovascular Surgery
Department of Surgery, Chiang Mai University Hospital**

Email: supapong.arworn@gmail.com



Chiang Mai University Hospital 2538-2549



**Division of Vascular Surgery
Department of Surgery
Siriraj Hospital 2549-2551**



Misunderstood about Diabetic Foot Ulcer Management

- We don't know how dangerous of diabetic ulcer.
- We don't know how special of diabetic ulcer.
- We think that diabetic ischemic ulcer is microvascular disease.
- We think DM ischemic ulcer should have PAD symptoms before.
- We think DM ulcer cannot be treated.

Diabetic Foot Ulcert

Three components interplay

1. Neuropathy
2. Infection
3. PAD (ischemia)

PAD

- Strongest prognostic indicator for non-healing ulcer (odd ratio 2.8)
- Strongest risk of amputation & death

Signs & Symptoms (problems)

1/3 have ischemic symptoms before

- Neuropathy
- Infection

40% have not investigated for PAD at all

1/2 amputated patients have no vasc. assessment before.

Delayed revasc.

→ Worse outcomes and higher amputation rate

DFUs associated with PAD in Thai Population

- Delayed in diagnosis & treatment
- Consequence



Possibility of revascularization



Major amputation



Overall mortality

Investigations (problems)

Non-compressible vessels due to calcified vessel wall

- ABI can be false elevated

Right ABI $\frac{\text{Higher right-ankle pressure}}{\text{Higher arm pressure}}$
Left ABI $\frac{\text{Higher left-ankle pressure}}{\text{Higher arm pressure}}$

Interpretation of ABI

> 1
 0.91
 0.41
 0.00

Interpretation of ABI

> 1.30	Noncompressible
0.91–1.30	Normal
0.41–0.90	Mild-to-moderate peripheral arterial disease
0.00–0.40	Severe peripheral arterial disease

Right-arm
systolic pressure

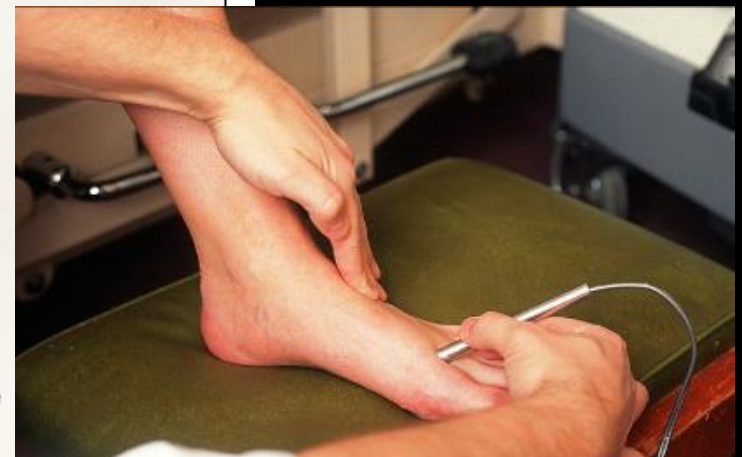
systolic pressure

Right-ankle
systolic pressure

DP
PT

Left-ankle
systolic pressure

DP
PT



Interpretation of ABI

> 1.30	Noncompressible
0.91–1.30	Normal
0.41–0.90	Mild-to-moderate peripheral arterial disease
0.00–0.40	Severe peripheral arterial disease

Medial wall calcification

- : Non-compressible
- : False elevated ankle pressure
- : Need alternative measurements

Peripheral Artery Disease

: Diagnostic Tools

History taking

- Walking problem
- Back pain

Physical examination

- Sign of chronic PAD
- Pulse exam.

Atrophic skin change

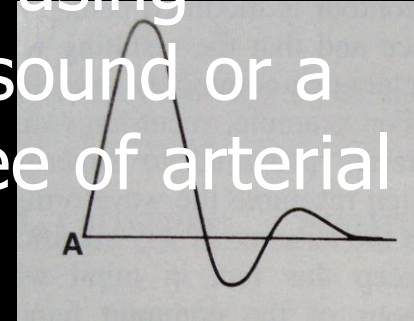
Leg & foot muscle atrophy

Prominent foot tendons



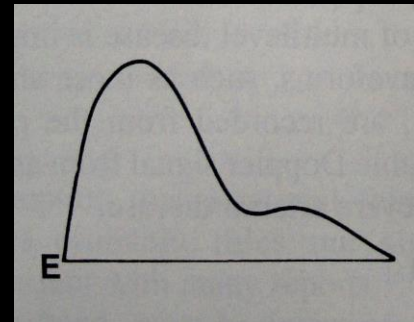
Velocity Waveform

: Measurement of blood flow velocity using Doppler ultrasound turns a signal to sound or a graph pattern to determine the degree of arterial stenosis



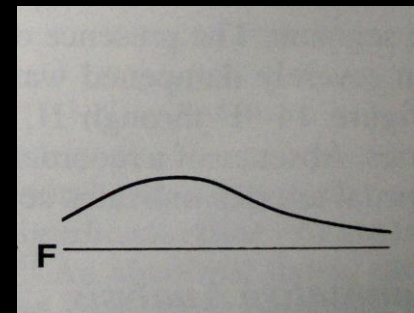
A Triphasic Pattern

- Normal



E Biphasic Pattern

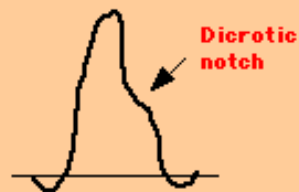
- Mild-mod degree occlusion



F Monophasic Pattern

- Severe occlusion

Pulse Volume Recording



Normal



Moderate disease

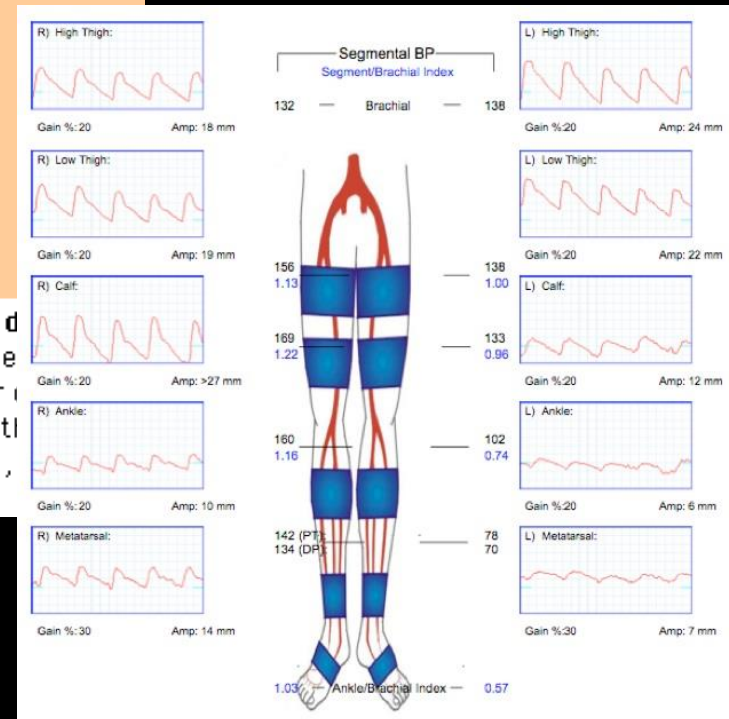


Early disease

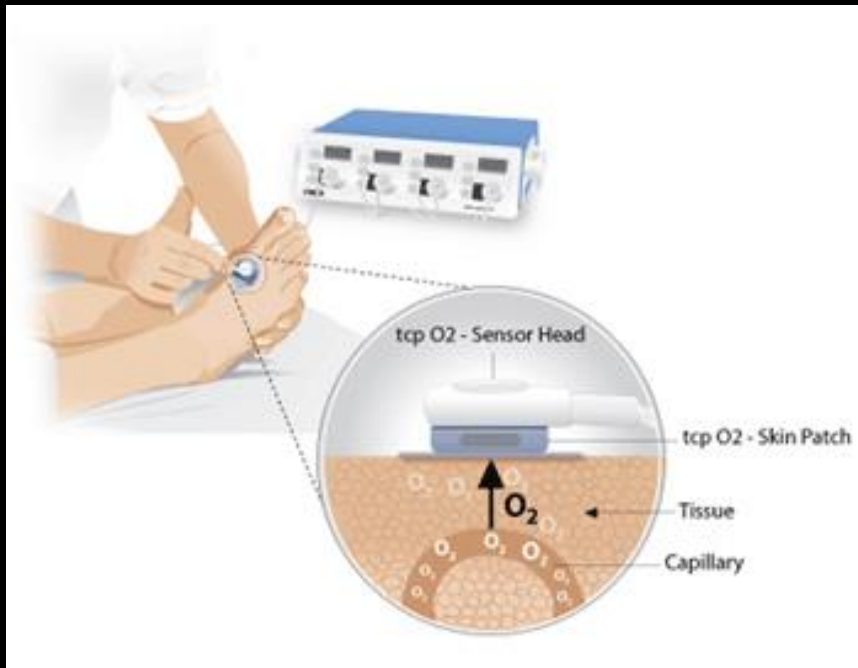


Severe disease

Segmental volume plethysmography in peripheral vascular disease
 Variations in the contours of the pulse volume recording with segmental volume plethysmography reflect the severity of peripheral vascular disease. Mild disease is characterized by the absence of a dicrotic notch. With progressive obstruction, the upstroke and downstroke become equal, and with severe disease, the amplitude of the waveform is blunted.



Transcutaneous O₂ Measurement (tcpO₂)



Critical Limb Ischemia

Inadequate arterial blood flow to accommodate the metabolic needs of resting tissue

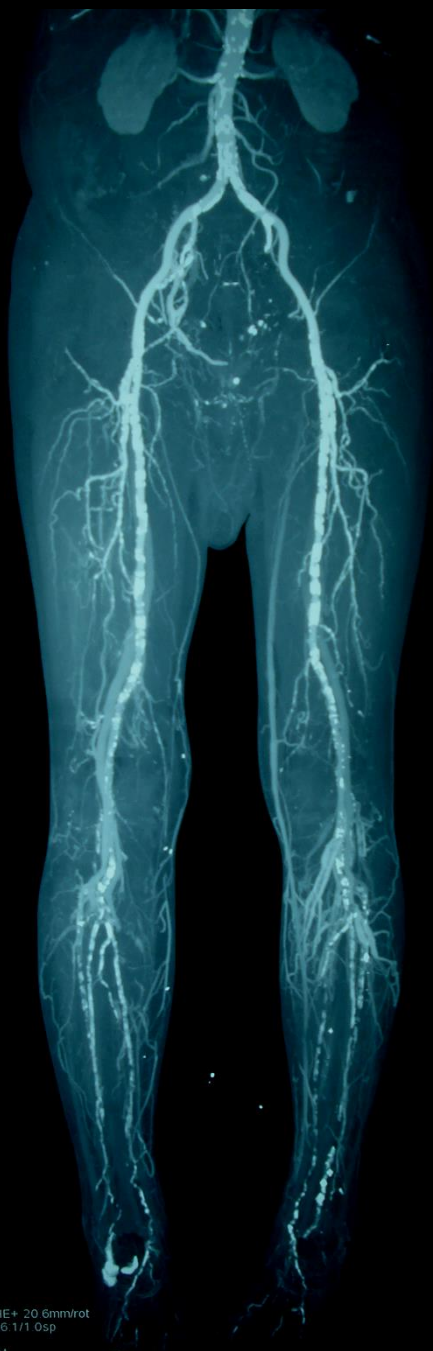
- Rest pain, Ulceration, gangrenous foot/ toe
- Ankle systolic pressure <50 mmHg
- Toe systolic pressure <30 mmHg



Fate over 1 years

After primary treatment

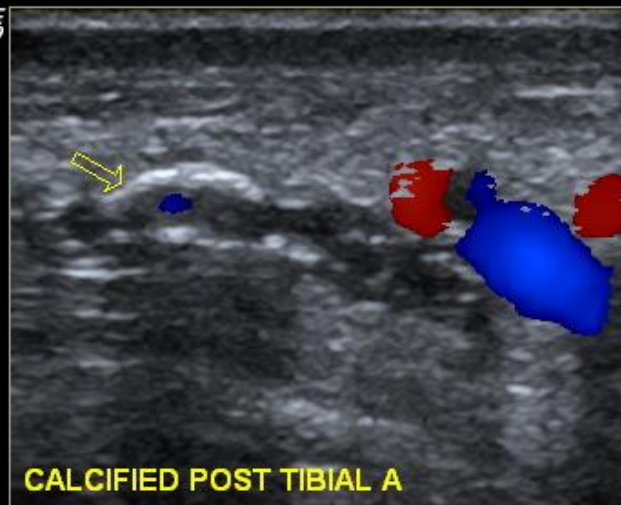
- 25% CLI resolved
- 20% Continuing CLI
- 30% Alive amputated
- 25% Dead **3/4 CV caused**



40 VOl
 14 120
 14A 352
 Rot 0.90s/HE+ 20.6mm/rot
 1.2mm 0.516 1/1 Osp
 TR 0.0
 17.76 68.00

2
 1
 -2
 cm/s

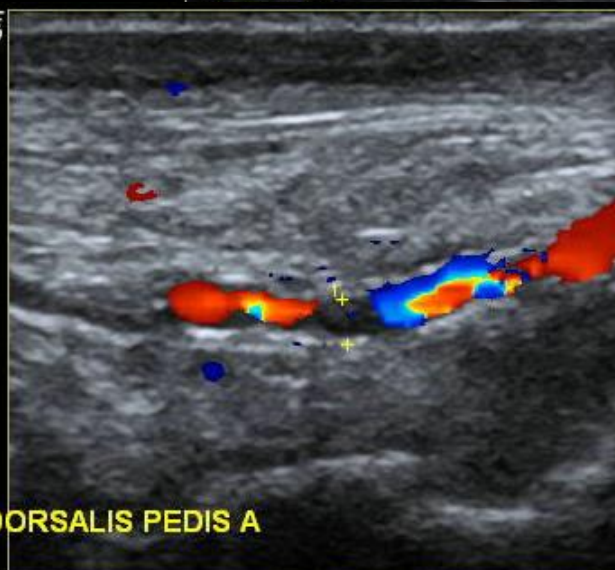
GE
 L9



CALCIFIED POST TIBIAL A

GE
 L9

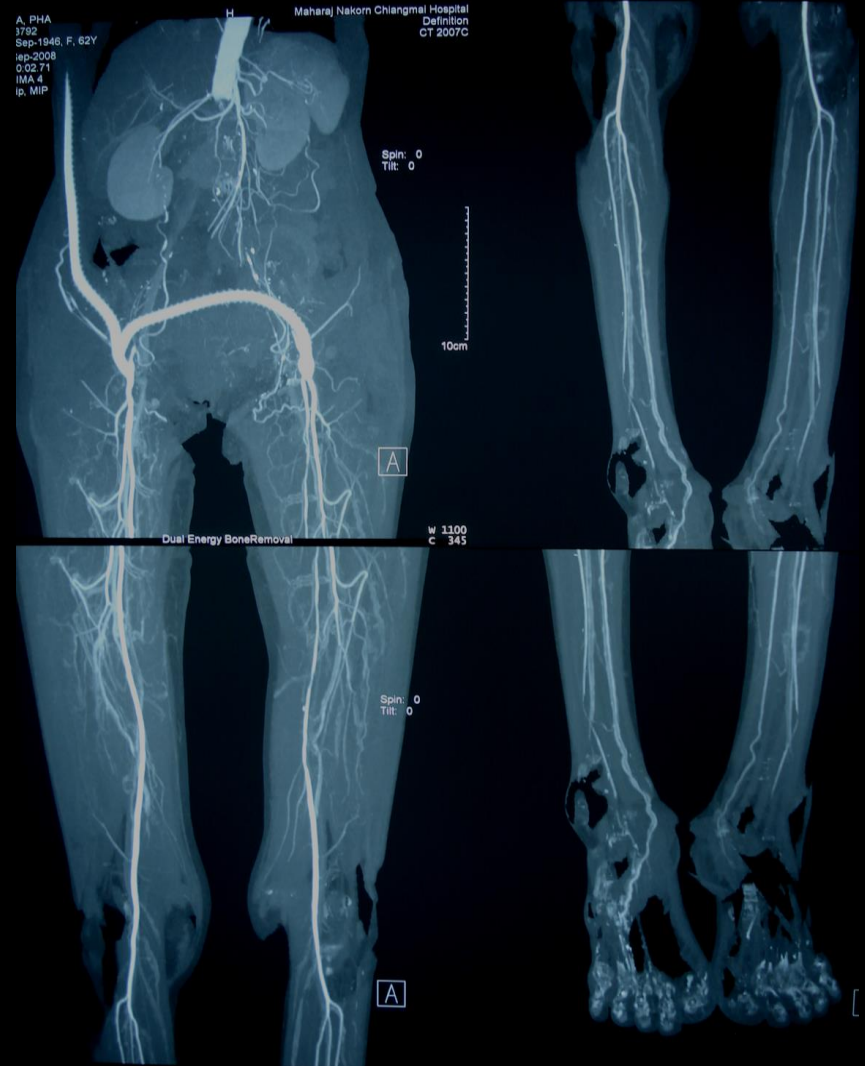
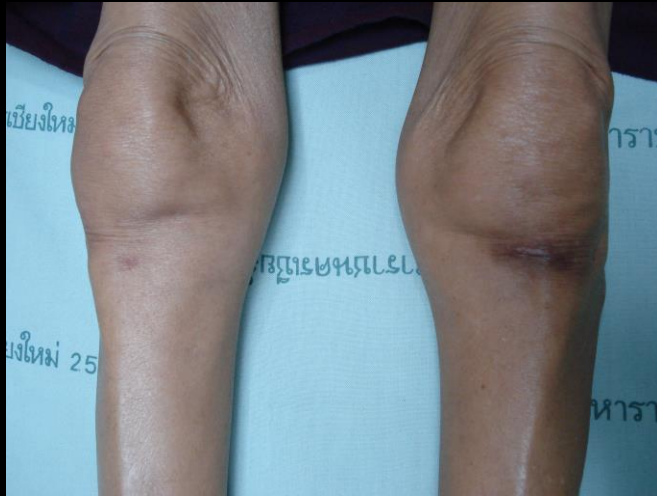
2
 1
 -2
 cm/s



DORSALIS PEDIS A

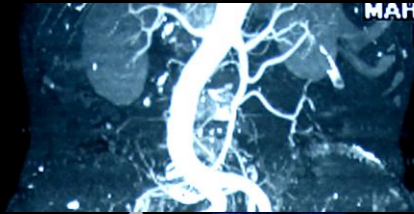


Axillo-bifemoral Bypass



Femoral-Posterior Tibial Artery Bypass

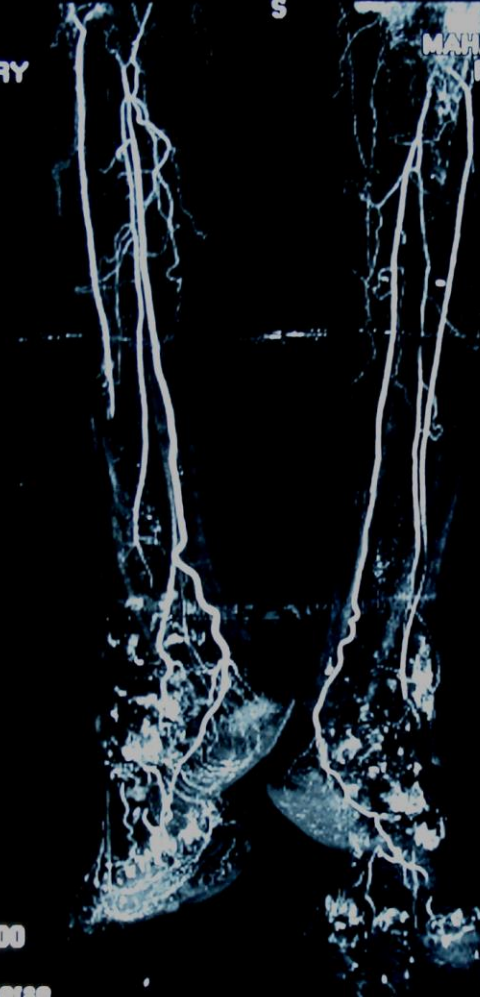
Im: 10
DERIVED\SECONDARY
512x512



MAHARAJ NAKORN CHIANGMAI
RALUEKPRAIPANA BOEBLA
061Y M 3125698
Acc: 46992
Ex: 46992
2008/08/21
16:40

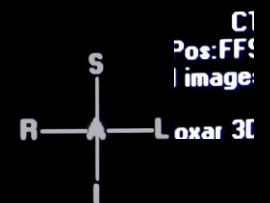


3D Color Volume
Im: 8
DERIVED\SECONDARY
512x512



MAHARAJ NAKORN CHIANGMAI
RALUEKPRAIPANA BOEBLA
061Y M 3125698
Acc: 46992
Ex: 46992
2008/08/21
16:40

L

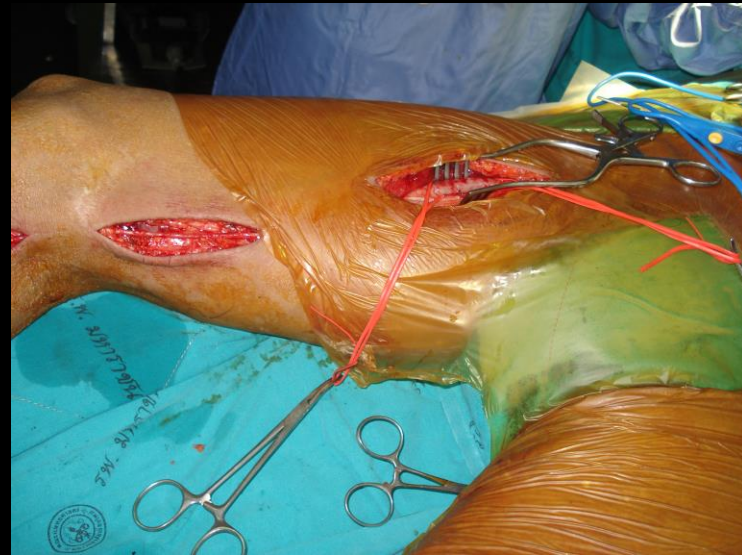
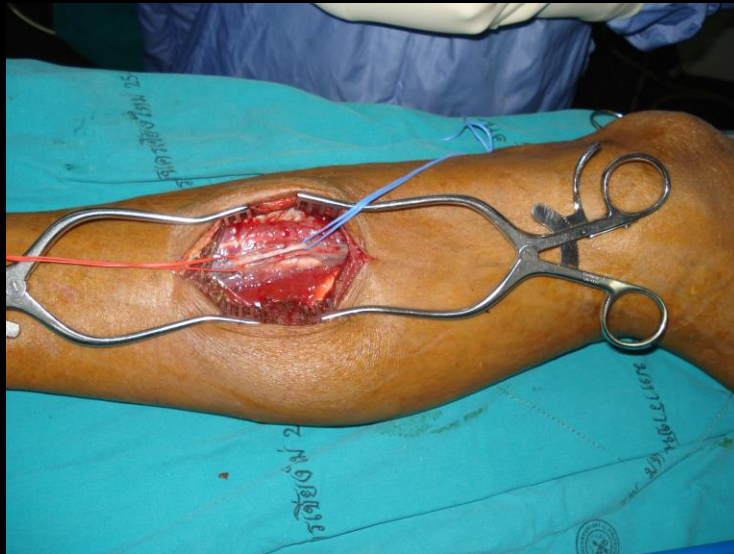


Vp: 120 mA: 250 ms: 500

12x512x1043 Transverse

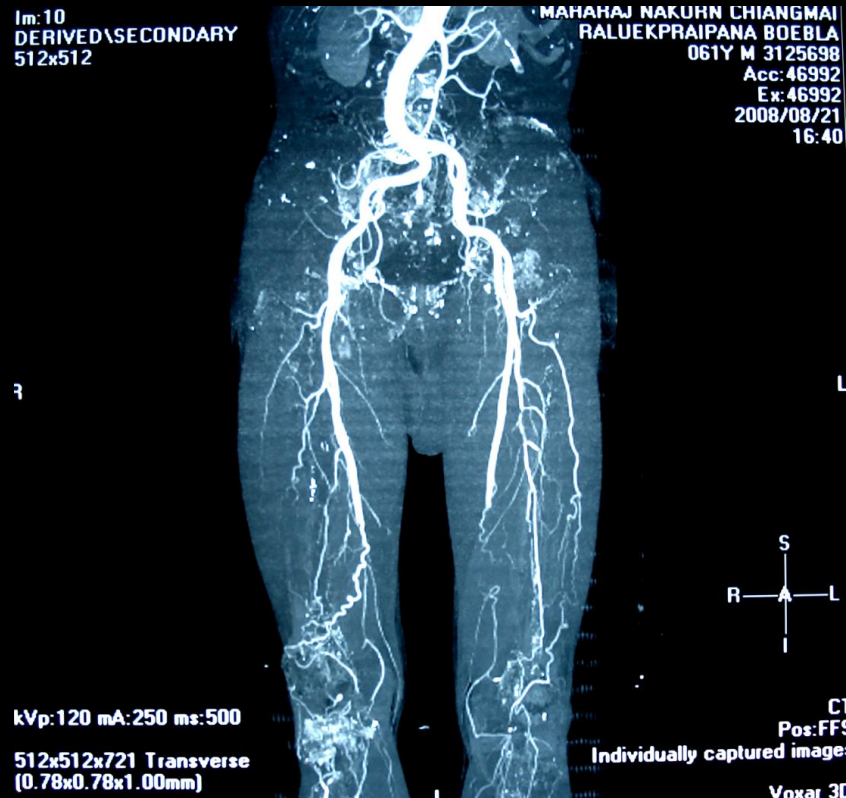
Individually captured image
C:
Pos: FF:
image:

Femoral-Posterior Tibial Artery Bypass



Femoral-Posterior Tibial Artery Bypass

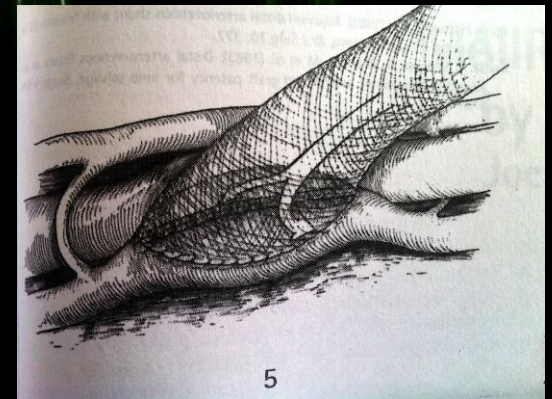
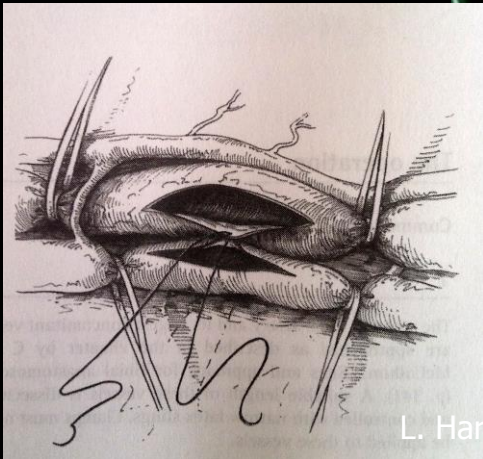
Post-Operative Study



Preoperative Study



Adjuvant AVF

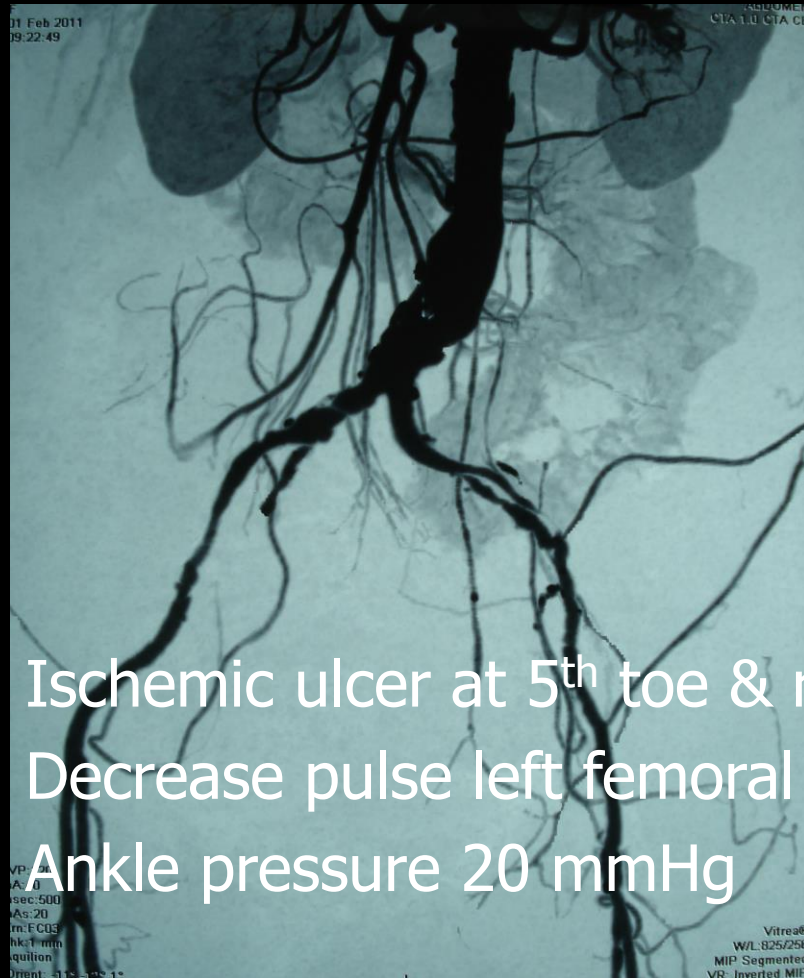


L. Harris. Adjuvant arteriovenous fistula at the distal anastomosis of a femorotibial bypass graft. In: R. M. Greenhalgh, editor. Vascular and Endovascular Surgical Techniques. 4th ed. Philadelphia: W.B. Saunders; 2001. p373-376

Femoral Artery- Posterior Tibial Vein Bypass



Iliac-femoral Artery : Angioplasty with primary stenting



Ischemic ulcer at 5th toe & rest pain
Decrease pulse left femoral artery
Ankle pressure 20 mmHg

Iliac-femoral Artery : Angioplasty with Primary Stenting



Ankle pressure 60 mmHg

Ischemic ulcer & pain resolved

Fem-pop segment → No further treatment

Femoropopliteal Artery : Angioplasty with Stenting



Known case CAD S/P CABG 4 months ago
Ischemic ulcer at dorsum of R foot & rest pain
Decrease pulse right popliteal artery
Ankle pressure 0 mmHg

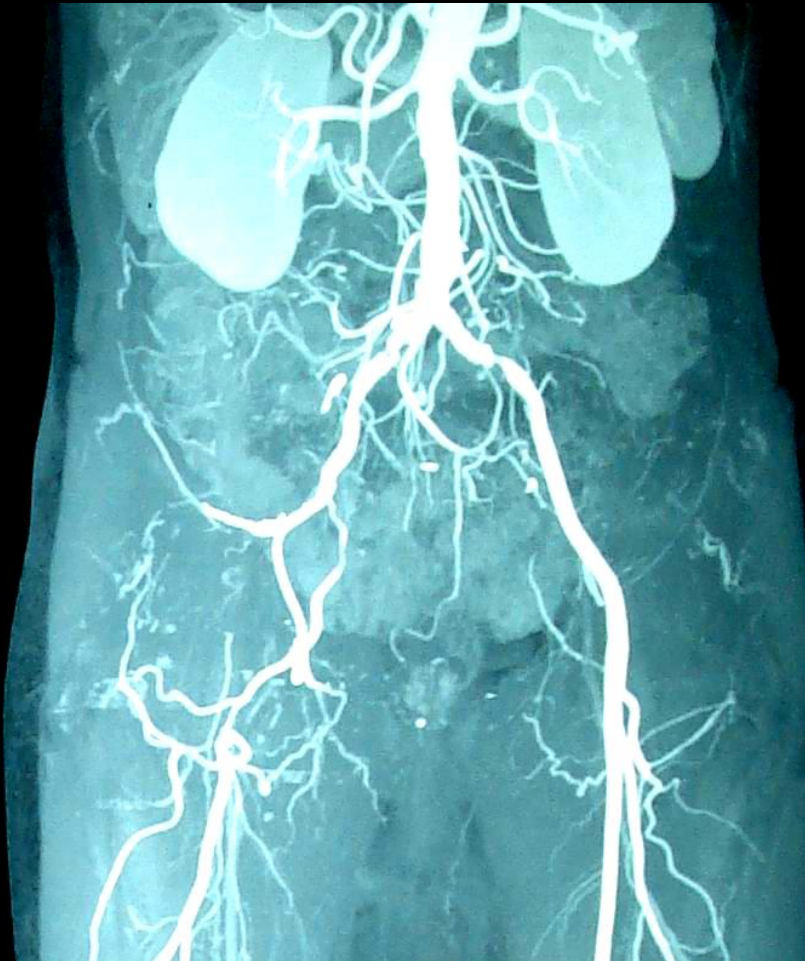
Femoropopliteal Artery : Angioplasty with Stenting



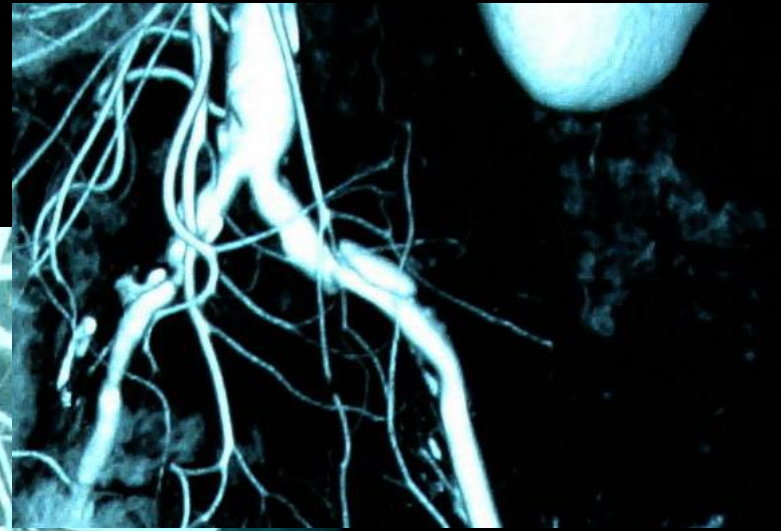
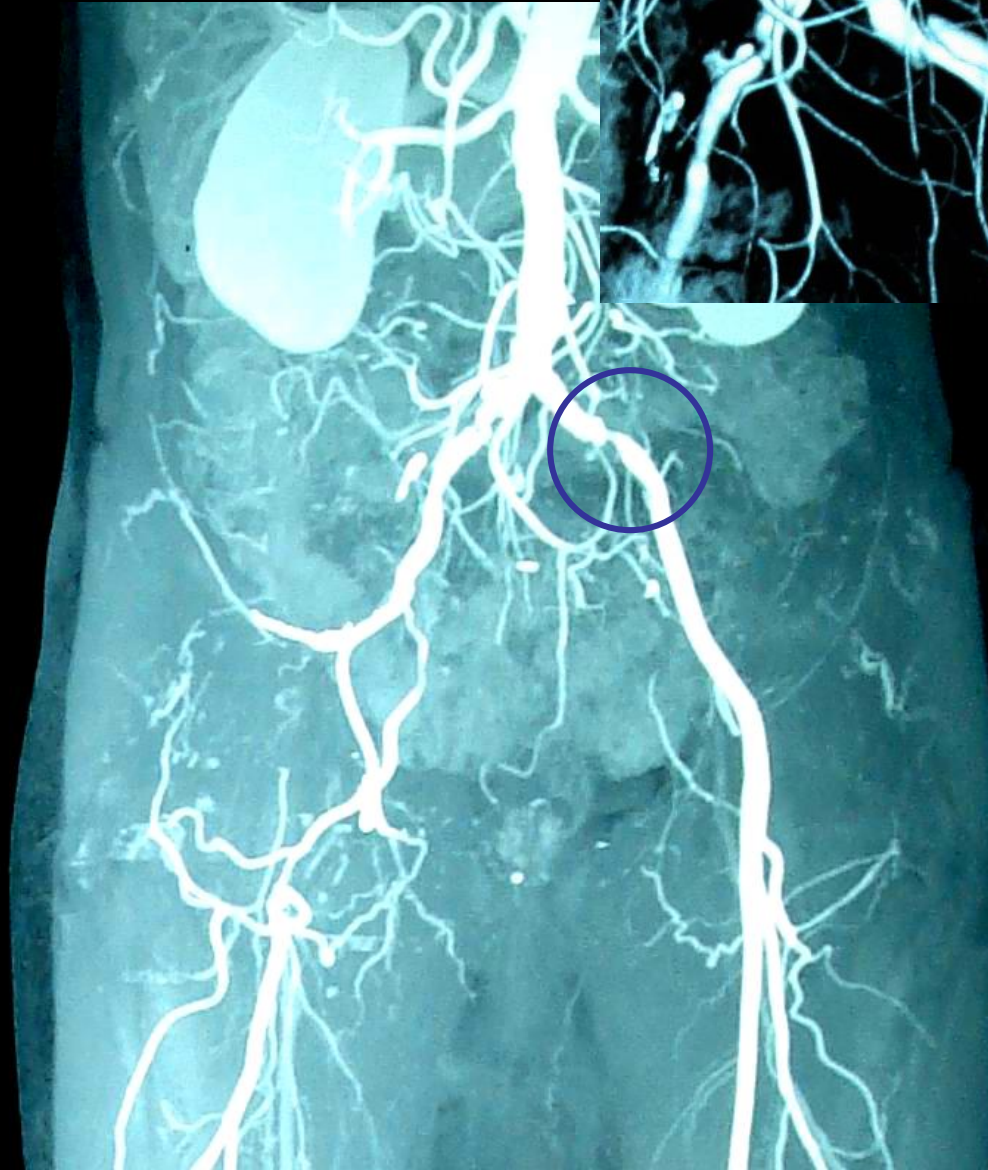
Ischemic ulcer & pain improved
Ankle pressure 50 mmHg



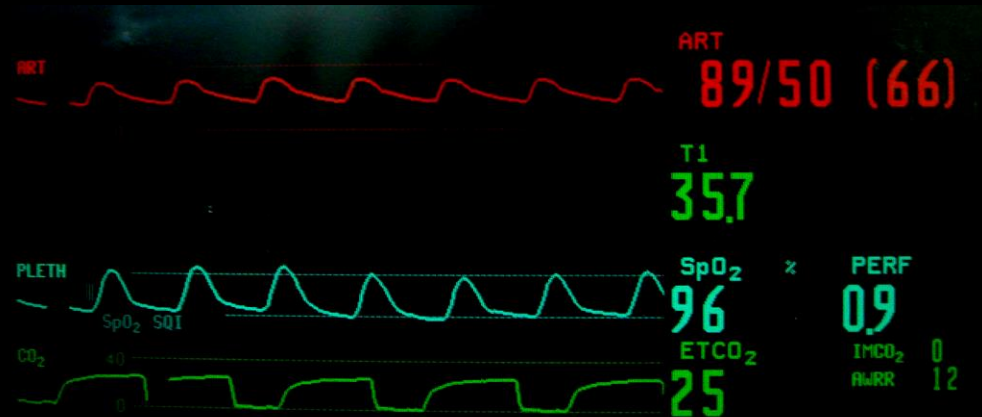
Hybrid Vascular Reconstruction



Hybrid Vascular Reconstruction



Hybrid Vascular Reconstruction



Chumpol W
Vascular abdominal
04-12-2006 13:47

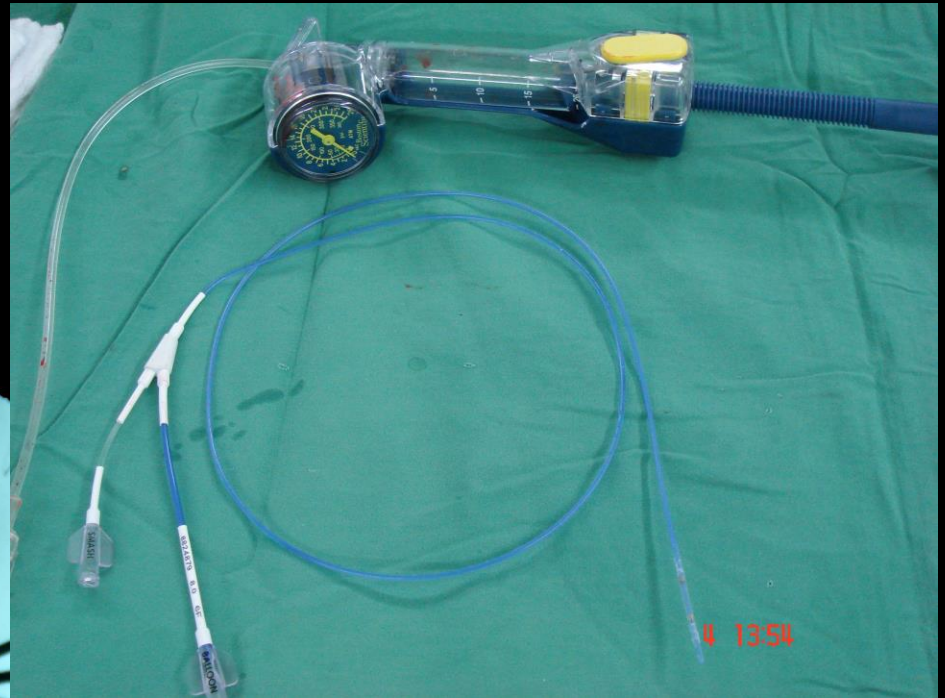
SUBTRACT

13
14-1
NUM THE DIFFERENCE

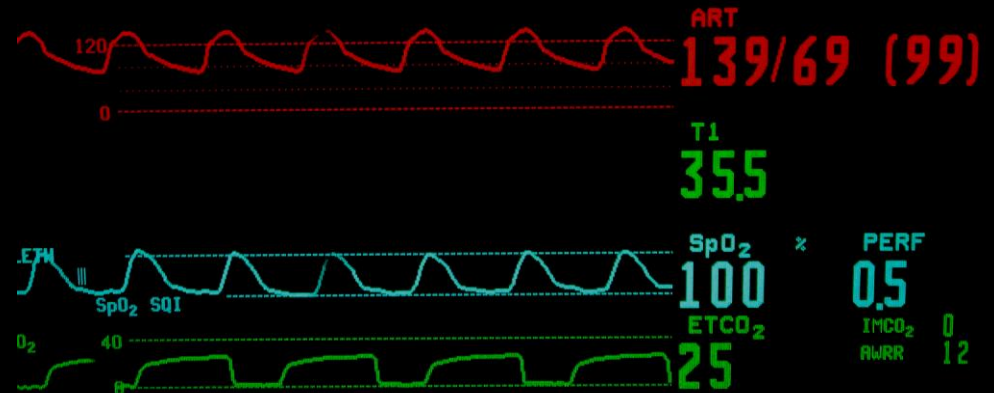
Hybrid Vascular Reconstruction

POUKIE SAENGEAW

PHILIPS BV Pulsera

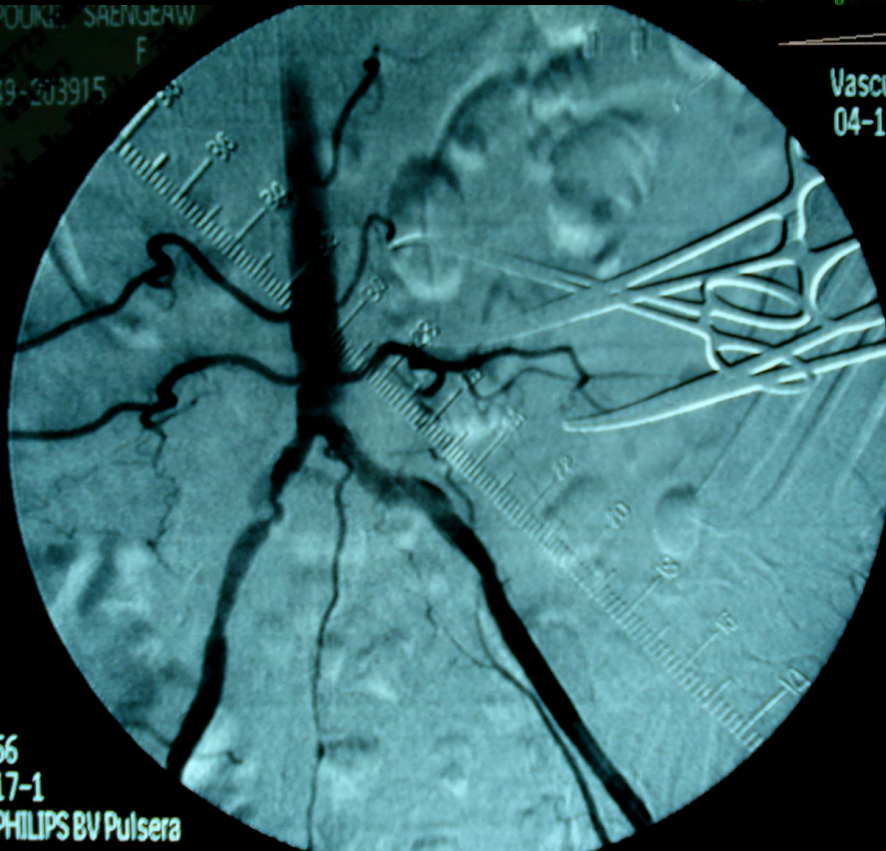


Hybrid Vascular Reconstruction



POURCE, SAENGSAW
F
49-203915

Channel w
Vascular abdominal
04-12-2006 14:46



SUBTRACT

56
17-1
PHILIPS BV Pulsera

Hybrid Vascular Reconstruction

e: 2 +c
olume Rendering No cut

FOV 50.9cm
TND+*



No VOI
kv 120
mA 351
Rot 0.60s/HE+ 20.6mm/rot
1.2mm 0.516:1/1.0sp
Tilt 0.0
08:42:42 AM
W = 4095 L = 2048

Dec 27 2006 HD MIP No cut

DFOV 50.9cm
STND+*



L R
MIP
GAIN

No VOI
kv 120
mA 351
Rot 0.60s/HE+ 20.6mm/rot
1.2mm 0.516:1/1.0sp
Tilt 0.0
08:42:42 AM
W = 4095 L = 2048

Key Points

- In Thai population, PAOD is under-diagnosed and under-rated.
- DFUs patients with vascular disease are associated with significant morbidity/mortality.
- Revascularization is the main stay treatment.

Endovascular Surgery

Bypass Surgery