Open Surgical Arterial Bypasses
To Deep Ankle Veins
With Distal Valve Disruption
For CLTI With No Distal Target Arteries

Pramook Mutirangura
President of Thai Vascular Association
Professor of Vascular Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Bangkok, Thailand

No disclosure

Open surgical arterial bypass
Theses procedures require the appropriate
• proximal arteries
• vascular conduits
• distal arteries
to provide adequate circulation in distal tissue.

Pedal bypasses
The most extensive open surgical arterial bypasses for CLTI requiring optimal status of distal pedal arteries

Calcified post-tibial a.
Heavy calcification & long occlusion of distal artery
Venous arterialisation (concept)

- Use of the disease-free venous bed as an alternative conduit for perfusion of the peripheral tissue with arterial blood.

**Venous systems in foot**

- Dorsal surface
  - Venous dorsal arch
  - Venous plantar arch
  - Greater saphenous v.
  - Medial plantar v.
  - Lateral plantar v.
  - Posterior tibial v.

- Plantar surface
  - Superficial v. system
  - Deep v. system

**PBDVA**

**Principle of surgical technique**

- Common femoral artery
- PTFE graft
- Proximal artery
- Composite graft
- Distal pedal vein

PBDVA: pedal bypass & deep venous arterialization

Mutrajunga P. Vascular 2011
Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption
Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption

Distal Vein Valve Disruption
Distal Vein Valve Disruption

Pedal vein anastomosis

Pedal vein anastomosis

Pedal vein anastomosis

Vein valve destruction
Pedal bypass with deep venous arterialization

Intraoperative angiography

Pedal artery bypass

Intraoperative angiography

Pedal bypass with deep venous arterialization

Pedal artery bypass

Intraoperative angiography
Rt ilio-posterior tibial v. bypass
Lt. ilio-posterior tibial a. bypass
Conclusions

- PBDVA has been proved to enhance limb salvage in critical limb ischemia with unreconstructable distal artery.

- PBDVA could tremendously increase not only blood supply to the ischemic foot but also collateral circulation of the whole ischemic leg.

- This hemodynamic change could maintain healthy foot circulation and provide limb salvage in the long term outcome.
Case Series
Pedal Bypass With Deep Venous Arterialization

Preoperative CTA
Postoperative CTA

PBDVA
Distal anastomosis

Preoperative CTA
Postoperative CTA

PBDVA
Foot circulation

Preoperative CTA
Postoperative CTA
Ankle pressure = 60 mmHg
ABI = 0.4
Transcutaneous oxygen pressure = 16 mmHg

Technical points of PBDVA
1. Selection of pedal deep v. for arterialization
2. Preservation of superficial v. for circulatory outflow
3. Use of composite graft as vascular conduit
4. Creation of complete distal valve incompetency
5. Meticulous surgical technique

1. Selection of pedal deep vein for arterialization

VDO

Selection of pedal deep vein for arterialization

Selection of pedal deep vein for arterialization
Selection of pedal deep vein for arterialization

2. Preservation of superficial v. for circulatory outflow

3. Use of composite graft as vascular conduit

Proximal vascular anastomosis

Anastomosis of composite graft

Contralateral vein harvesting & graft tunnelling

Harvested long saphenous vein
4. Creation of complete distal valve incompetency

5. Meticulous surgical technique
Closure of surgical wounds

Should proximal vein at distal anastomosis be ligated?

Why did forefoot become necrosis in some patients?

Long term outcome of PBDVA

Postoperation 1 year  Postoperation 5 years  VDO & Sound

Postoperation 1 year  Postoperation 5 years  VDO & Sound
Transcutaneous oxygen pressure

**Preoperative**
- $O_2$ pressure = 16 mmHg

**Postoperative**
- $O_2$ pressure = 63 mmHg

Transcutaneous oxygen pressure measurement

- <20 mmHg: Poor healing
- 20-40 mmHg: Equivocal
- >40 mmHg: Good healing

Foot level

Postoperation 1 year

Immediate postoperation

Postoperation 5 years

HM King Rama IX
The Great King of Thailand
Duplex ultrasonography

distal v.  proximal a.

Intraoperative angiography

Distal anastomosis at Rt. dorsalis pedis artery bypass (plantar arterial arch)

Distal anastomosis at Lt. posterior tibial vein bypass (plantar venous arch)

Intraoperative angiography

Distal anastomosis at Rt. dorsalis pedis artery bypass (plantar arterial arch)

Distal anastomosis at Lt. posterior tibial vein bypass (plantar venous arch)

Surgical procedure

Venous system in foot

Dorsal venous arch
Plantar venous arch
Greater saphenous v.
medial plantar v.
Lateral plantar v.
Posterior tibial v.

Vascular isolation

distal v.  proximal a.

Posterior tibial vein
Femoral artery
Aorto-bipopliteal a. bypass

Arterial bypass
Arterial reconstruction requiring appropriate
- proximal artery
- vascular conduit
- distal artery
to provide adequate circulation in distal tissue.

Preservation of superficial v. for circulatory outflow

Postoperative 4 weeks
Postoperative 2 years