Pedal Bypass With Deep Venous Arterialization:

Long Term Result For Critical Limb Ischemia

With Unreconstructable Distal Arteries

Pramook Mutirangura

Professor of Vascular Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University
Bangkok Thailand
No Disclosure
Critical limb ischemia
Unreconstructable distal artery

Completely occluded & calcified pedal artery
Heavy calcification and severe stenosis of the pedal artery
Conventional pedal artery bypass
Pedal bypass with deep venous arterialization (PBDVA)

Principle of surgical technique

![Diagram of surgical technique](image)

- Common femoral artery
- Common femoral vein
- Long saphenous vein
- PTFE graft
- Vein graft
- Posterior tibial vein
- Posterior tibial artery

proximal artery ➔ composite graft ➔ distal pedal vein
Critical limb ischemia

Ankle pressure = 60 mmHg

ABI = 0.4

Oxygen pressure = 16 mmHg
Preoperative assessment
Duplex ultrasonography: assessment of pedal vein

3 mm. posterior tibial vein
Duplex ultrasonography: proximal femoral artery
Pedal bypass with deep venous arterialization (PBDVA)

Steps of the surgical procedure
PBDVA surgical technique

The patient in supine position
PBDVA surgical technique

Posterior tibial vein isolation
PBDVA surgical technique

Proximal femoral artery isolation
PBDVA surgical technique

Contralateral vein harvesting & graft tunnelling
Harvested long saphenous vein
Proximal vascular anastomosis

PBDVA surgical technique
PBDVA surgical technique

Anastomosis of composite graft
PBDVA surgical technique

Composite graft
PBDVA surgical technique

Blood flow through composite graft
PBDVA surgical technique

Posterior tibial venotomy
Vascular dilator for destruction of valvular competency
PBDVA surgical technique

Distal vascular anastomosis
PBDVA surgical technique

Distal vascular anastomosis
PBDVA surgical technique

Distal vascular anastomosis
PBDVA surgical technique

Complete vascular anastomosis
VDO: intraoperative angiography
Intraoperative angiography
PBDVA surgical technique

Closure of surgical wounds
Complete healing of ischemic ulcer

Preoperative

Postoperative
Distal anastomosis (VDO)

Preoperative CTA  Postoperative CTA
Foot circulation

Preoperative CTA

Postoperative CTA
**Transcutaneous oxygen pressure**

**preoperative**

<table>
<thead>
<tr>
<th>Electrode</th>
<th>20 min Supine</th>
<th>5 min Elevate limb</th>
<th>5 min Supine</th>
<th>10 min O₂ 100%</th>
<th>5 min Supine</th>
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</thead>
<tbody>
<tr>
<td>Electrode 1</td>
<td>26</td>
<td>25</td>
<td>22</td>
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<td>Electrode 2</td>
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<td>Mean 2,3</td>
<td>0.63</td>
<td>0.44</td>
<td>0.59</td>
<td>0.87</td>
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**Electrode Sites:**

- Electrode 1
- Electrode 2
- Electrode 3
- Electrode 4
- Electrode 5

**O₂ pressure = 16 mmHg**

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**postoperative**

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<tr>
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<td>Electrode 2</td>
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<tr>
<td>Mean 2,3</td>
<td>63</td>
<td>57</td>
<td>66</td>
<td>128</td>
<td>65</td>
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</tbody>
</table>

**Electrode Sites:**

- Electrode 1
- Electrode 2
- Electrode 3
- Electrode 4
- Electrode 5

**O₂ pressure = 63 mmHg**
Transcutaneous oxygen pressure measurement

Foot level

- <20 mmHg: Poor healing
- 20-40 mmHg: Equivocal
- >40 mmHg: Good healing
Postoperation 1 year

Postoperation 5 years
Immediate postoperation

Postoperation 5 years
Quality of life

Postoperation : 1 year

Postoperation : 5 year
Long term outcomes of PBDVA (n=40)
Hemodynamic changes in CLI treated by PBDVA
Postoperative duplex ultrasonography

Immediate postoperation

5-year postoperation
Postoperative duplex ultrasonography

Immediate postoperation

5-year postoperation
PBDVA

Lt. femoral artery → Lt. posterior tibial vein

Preoperative

Postoperative
Long term outcome: good quality of life

6 year-follow-up
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 follow-up.
Comparative study of venous arterialization and pedal bypass in a patient cohort with critical limb ischemia

<table>
<thead>
<tr>
<th></th>
<th>Pedal bypass (n = 19)</th>
<th>Venous arterialization (n = 21)</th>
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<tbody>
<tr>
<td>Early occlusion</td>
<td>23%</td>
<td>15%</td>
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<tr>
<td>1-year patency</td>
<td>75%</td>
<td>71%</td>
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<tr>
<td>Limb salvage</td>
<td>47%</td>
<td>53%</td>
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</table>

Equal limb salvage

After venous arterialization (poor distal a.)

After pedal bypass surgery (good distal a.)

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