

Evidence  
Based  
Approach:  
Open Surgical  
Bypass

Libby Watch, MD

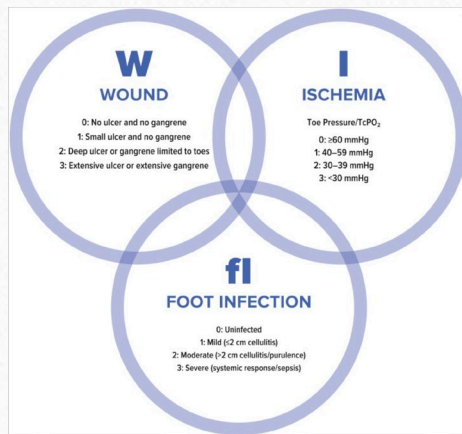
Baptist Health South  
Florida

# Lower Extremity Bypass Indications

- Claudication
- Critical limb ischemia
- TransAtlantic Inter-Society Consensus (TASC) type D lesions: complete CFA/SFA/popliteal and/or proximal trifurcation occlusion <sup>1,2</sup>

1 **L Norgren, et al.**: Inter-society consensus for the management of peripheral arterial disease (TASC II). *J Vasc Surg.* 45 (suppl S):S5-S67 2007 [PMID:17223489](#)

2 **JA Dormandy, et al.**: Management of peripheral arterial disease (PAD). TASC Working Group. Trans Atlantic Inter-Society Consensus (TASC). *J Vasc Surg.* 31:S1-S296 2000 [PMID:10666287](#)



	Ischemia 0	Ischemia 1	Ischemia 2	Ischemia 3
Wound 0	VL	VL	VL	a
Wound 1	VL			
Wound 2				
Wound 3				

VL, Very low benefit from revascularization (unlikely to require revascularization).

**a W0 I3 (Wound 0, Ischemia 3) patients = rest pain, no tissue loss; most such patients would benefit from revascularization.**

Grade	Category	Clinical description	Objective criteria
0	0	Asymptomatic-no hemodynamically significant occlusive disease	Normal treadmill or reactive hyperemia test
	1	Mild claudication	Completes treadmill exercise; AP after exercise > 50 mmHg but at least 20 mmHg lower than resting value
	2	Moderate claudication	Between categories 1 and 3
I	3	Severe claudication	Cannot complete standard treadmill exercise, and AP after exercise < 50 mm Hg
	4	Ischemic rest pain	Resting AP < 40 mmHg, flat or barely pulsatile ankle or metatarsal PVR; TP < 30 mm Hg
II	5	Minor tissue loss non-healing ulcer, focal gangrene with diffuse pedal ischemia	Resting AP < 60 mm Hg, ankle or metatarsal PVR flat or barely pulsatile; TP < 40 mm Hg
	6	Major tissue loss-extending above TM level, functional foot no longer salvageable	Same as category 5

AP: ankle pressure; PVR: pulse volume recording; TM: transmetatarsal; TP: toe pressure.

Rutherford classification for chronic limb ischemia.

The Society for Vascular Surgery Lower Extremity Threatened Limb Classification System: Risk stratification based on Wound, Ischemia, and foot Infection (WIFI)

Joseph L. Mills Sr., MD Michael S. Conte, MD David G. Armstrong, DPM, MD, PhD ...

Anton N. Sidawy, MD, MPH George Andros, MD

on behalf of the Society for Vascular Surgery Lower Extremity Guidelines Committee Show all authors

Published: October 14, 2013 DOI: <https://doi.org/10.1016/j.jvs.2013.08.003>

# Preoperative Assessment

## Imaging

- Physiologic studies
- CTA/MRA
- Catheter angiography is gold standard for target vessel identification
- Conduit assessment



## Medical Optimization

- Cardiology evaluation
  - perioperative MI risk 2 to 6.5%
- Medical management of diabetes, HTN, angina
- Wound care

[J Vasc Surg.](#) 1990 Jun;11(6):745-51; discussion 751-2. doi: 10.1067/mva.1990.19884.

[Journal of vascular surgery](#)

**Efficacy of the dorsal pedal bypass for limb salvage in diabetic patients: short-term observations**

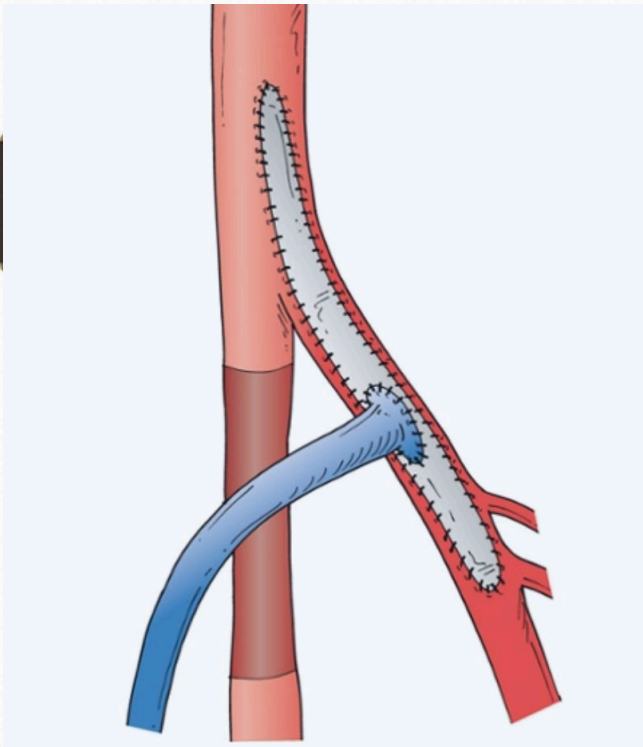
F B Pomposelli Jr <sup>1</sup>, S J Jepsen, G W Gibbons, D R Campbell, D V Freeman, A Miller, F W LoGerfo

Affiliations + expand

PMID: 2359188 DOI: 10.1067/mva.1990.19884

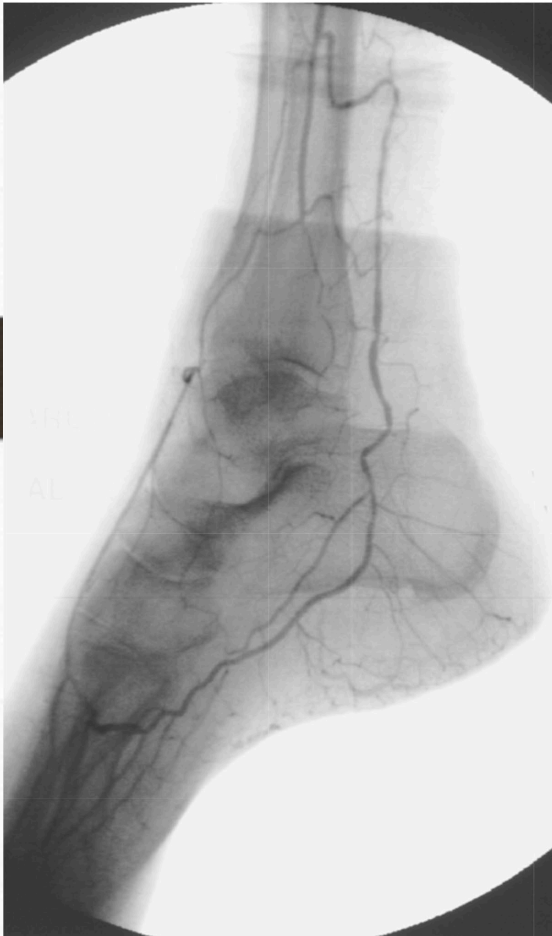


# Operative Planning-- Inflow



- Address iliac lesions
- Intraoperative pressure measurement of the inflow artery<sup>4</sup>
- Concomitant femoral endarterectomy (SFA, vein or bovine patch)
- Inflow from distal most healthy artery
  - Shortest bypass
  - Best conduit if vein limited

# Operative Planning--Outflow

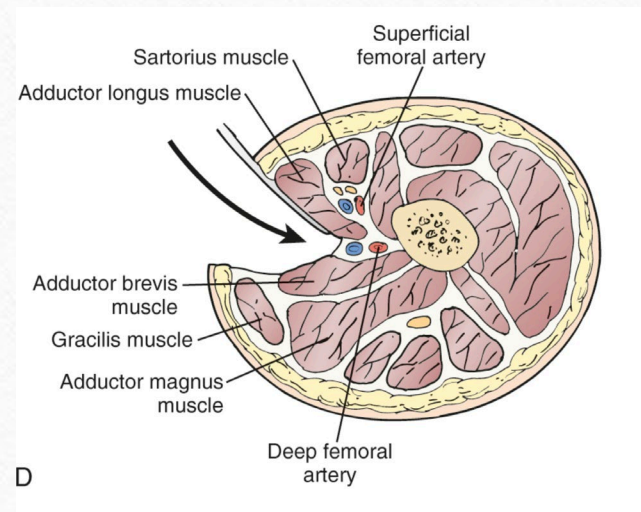
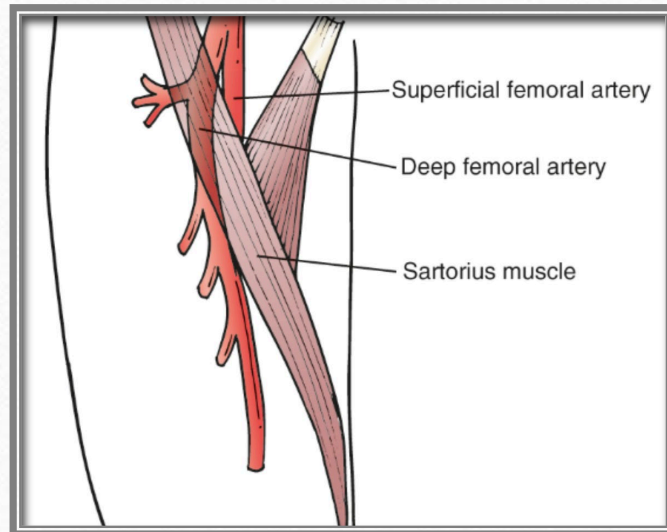


- Healthy popliteal artery is best
- Select most proximal segment of tibial or peroneal artery with runoff to the foot
- Target—proximal peroneal or pedal?
- Palpable pedal pulse needed to heal<sup>3</sup>

• **FB Pomposelli Jr, et al.:** Efficacy of the dorsal pedal bypass for limb salvage in diabetic patients: short-term observations. *J Vasc Surg.* 11:745-751 1990 [PMID: 2359188](https://pubmed.ncbi.nlm.nih.gov/2359188/)

Rutherford Vascular Surgery and Endovascular  
Therapy 9th Edition

# Exposure

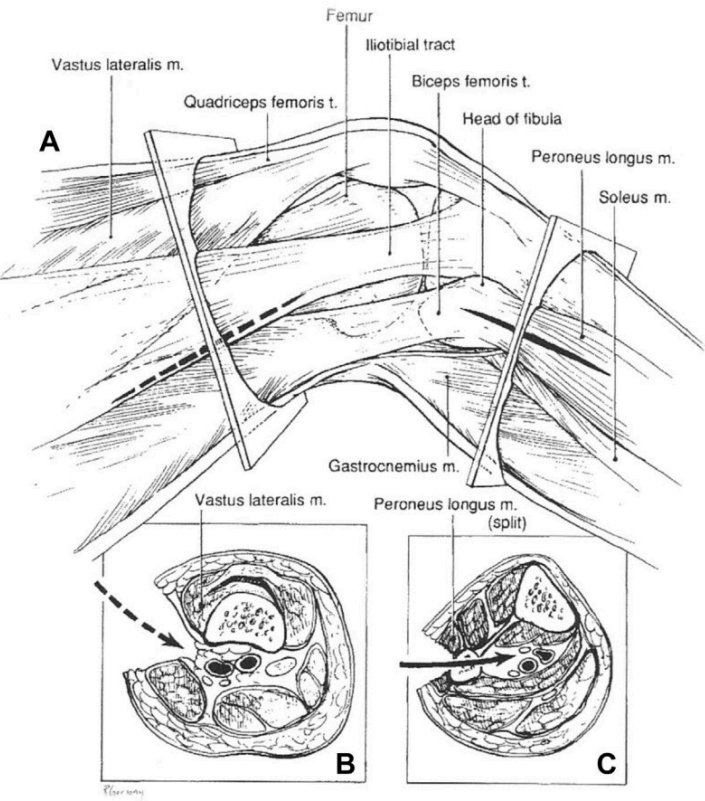


- Profunda femoral, SFA and lateral popliteal arteries can serve alternative inflow site <sup>5,6</sup>

› **JL Mills, et al.:** The role of the deep femoral artery as an inflow site for infrainguinal revascularization. *J Vasc Surg.* 18:416-423 1993 [PMID: 8377235](#)

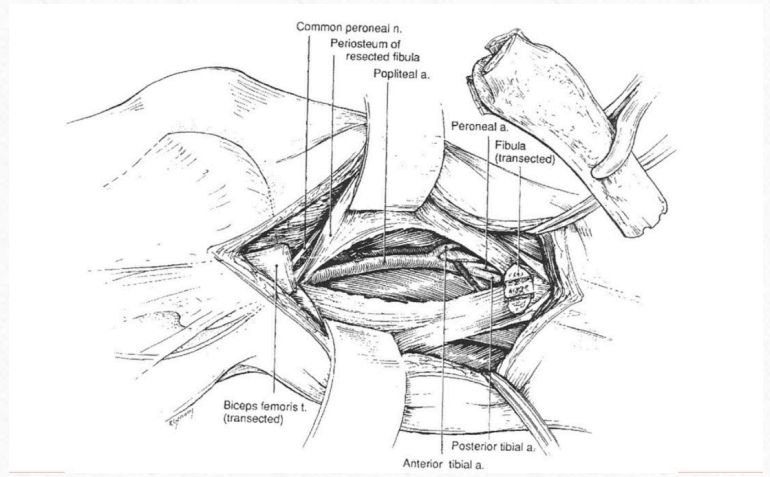
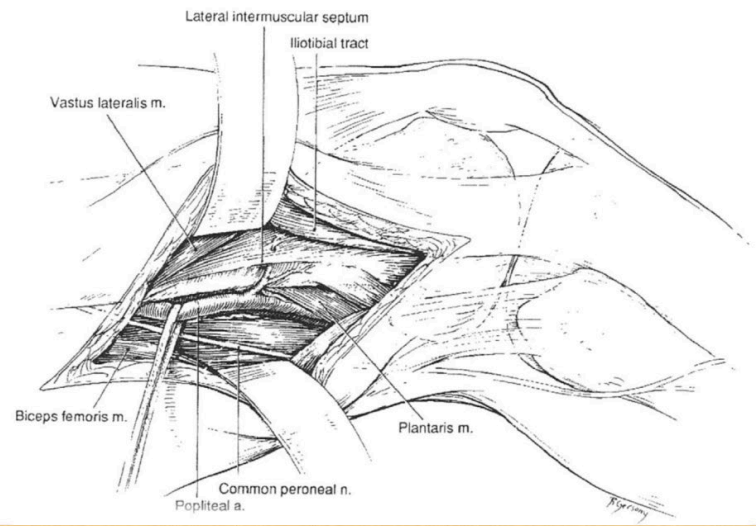
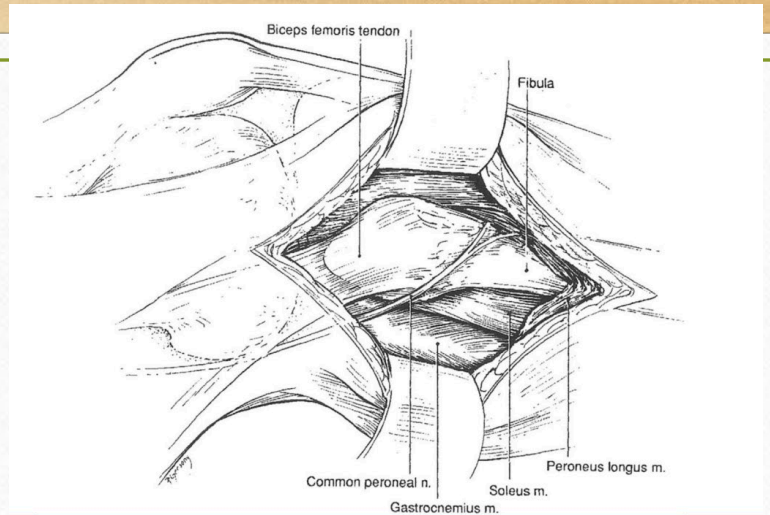
› **FJ Veith, et al.:** Superficial femoral and popliteal arteries as inflow sites for distal bypasses. *Surgery.* 90:980-990 1981 [PMID: 7313952](#)



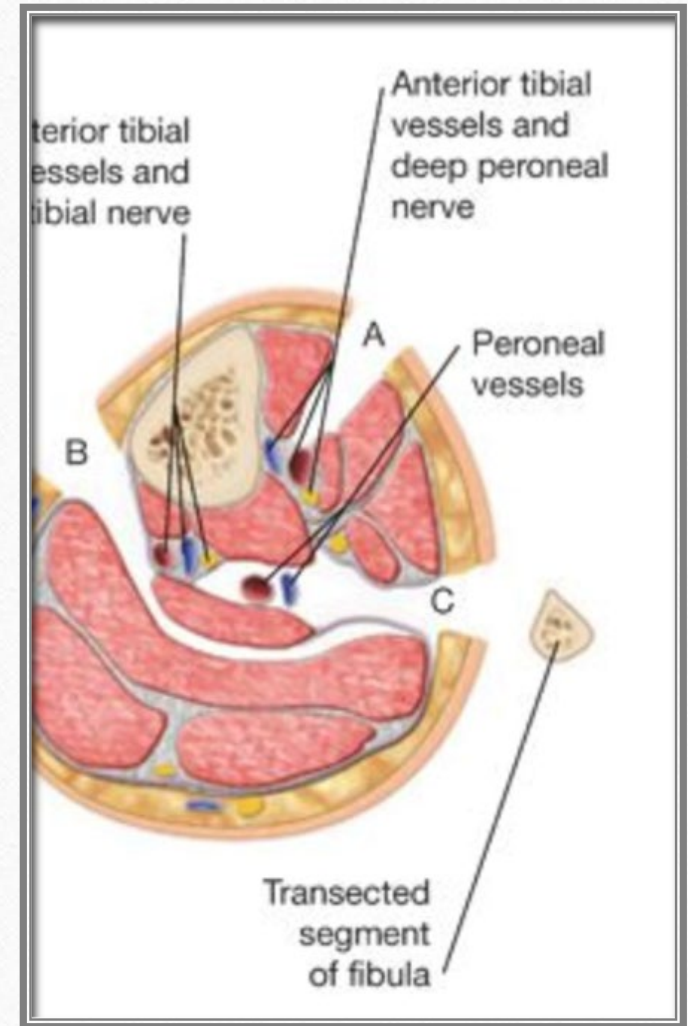
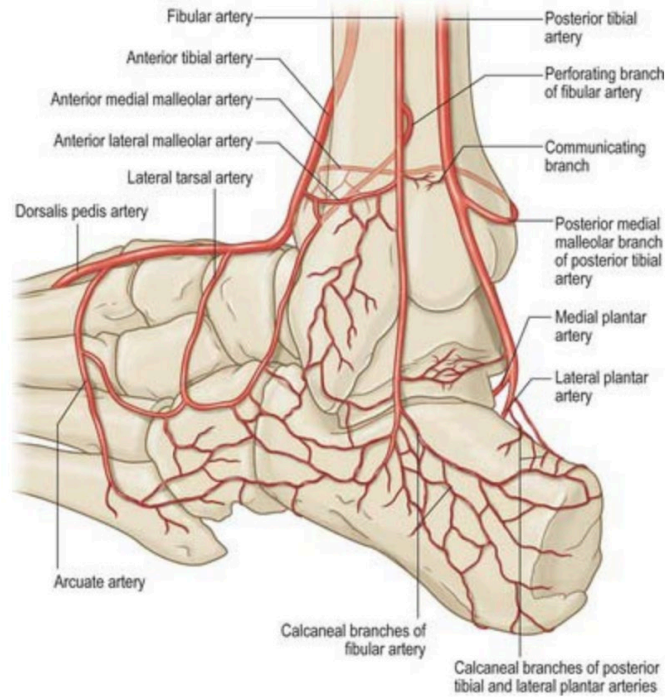
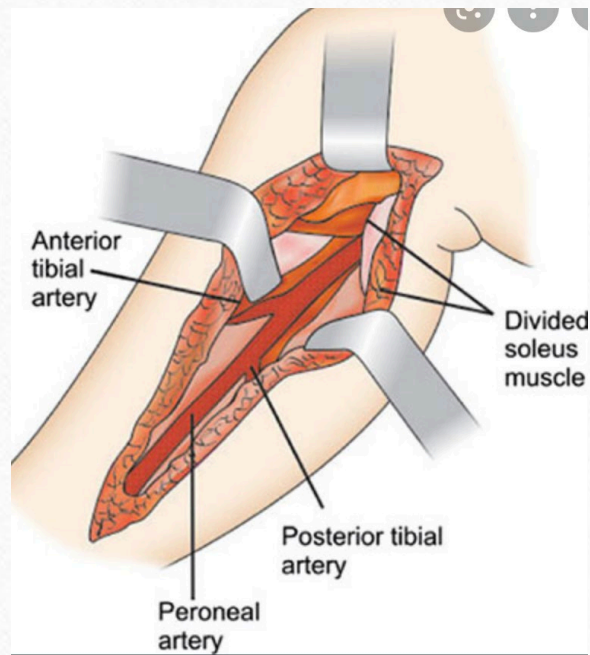


**Unusual surgical exposures to avoid scarred or infected standard access routes to the common femoral, deep femoral, and popliteal arteries**

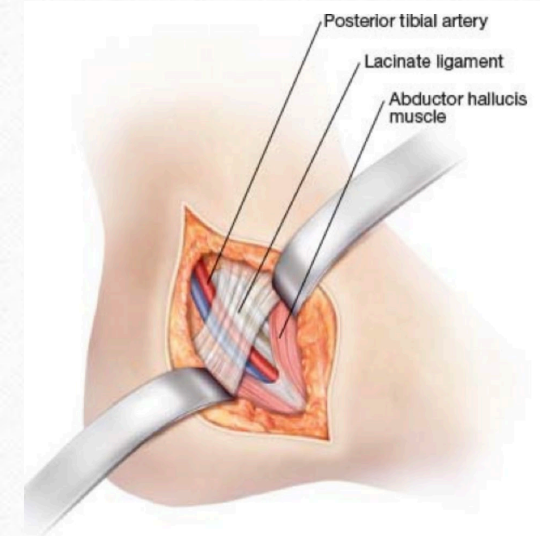
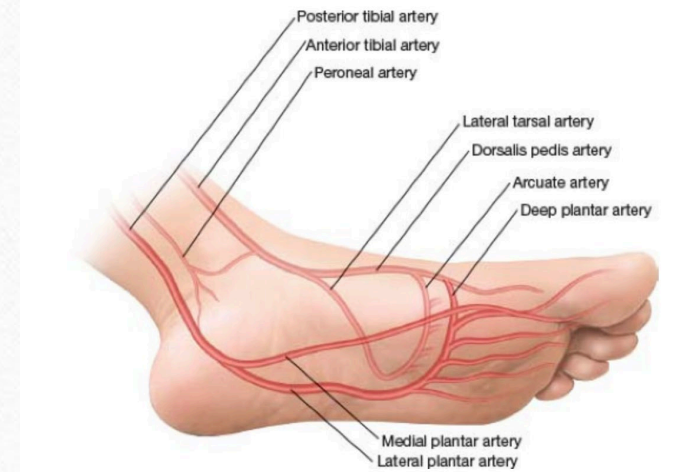
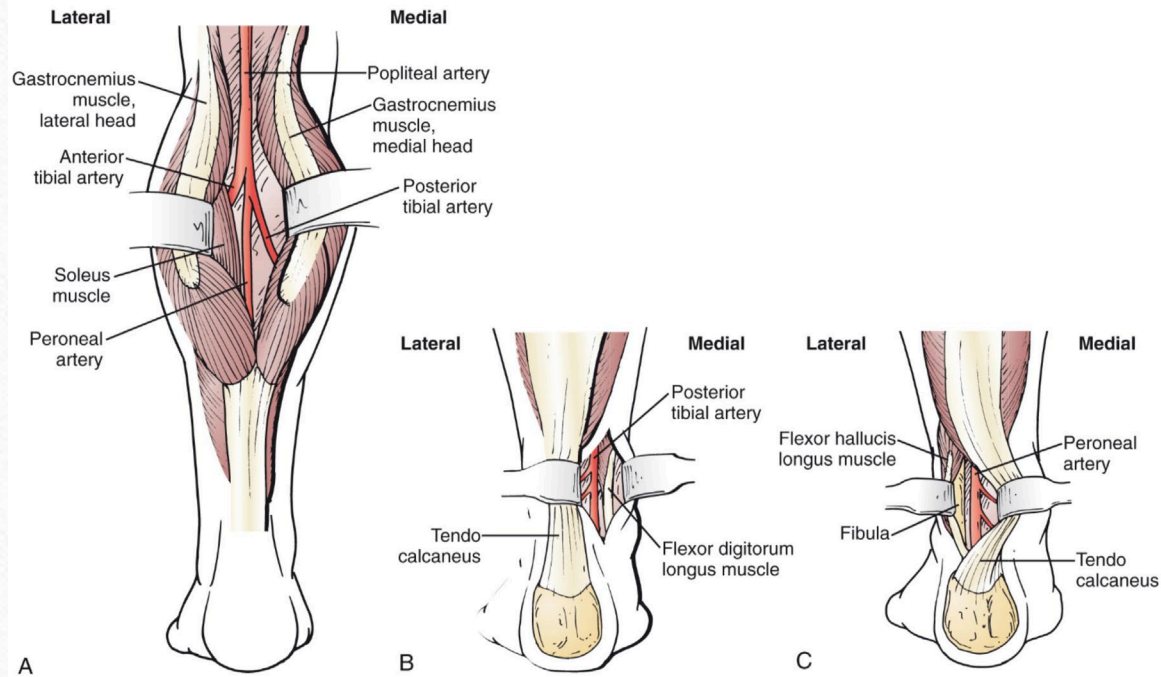
Frank J. Veith, MD,<sup>a,b</sup> Enrico Ascher, MD,<sup>a,c</sup> and Neal S. Cayne, MD,<sup>a</sup> New York and Brooklyn, NY; and Cleveland, Ohio



# Exposure



# Exposure



Ouriel K. Posterior exposure for popliteal-crural bypass: a useful approach. *Semin Vasc Surg.* 1997;10(1):23-30.

Rutherford Vascular Surgery and Endovascular Therapy 9th Edition  
(Illustrations)

<https://thoracickey.com/plantar-and-tarsal-artery-reconstructions/>

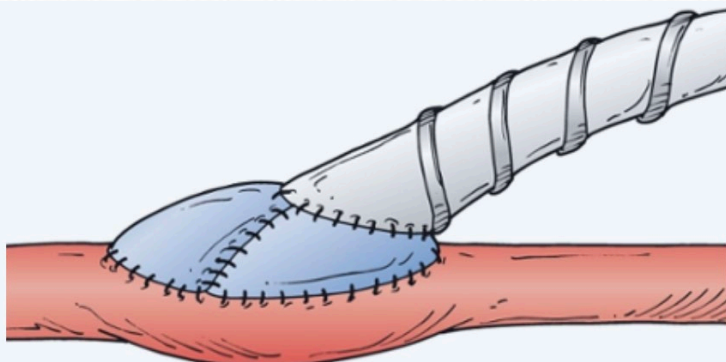
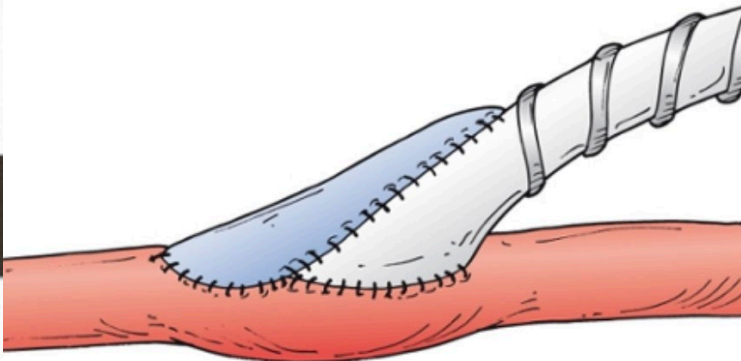
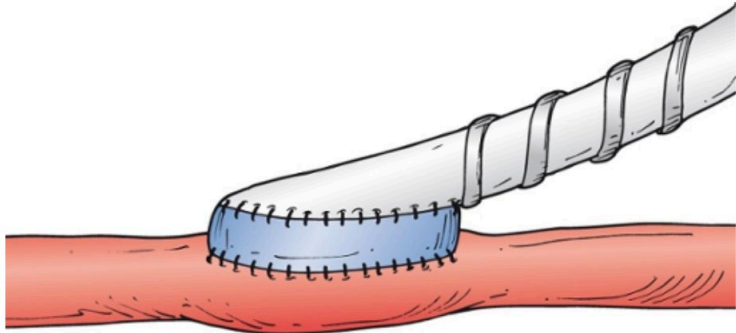
# Conduit

- Ipsilateral GSV best choice
- Contralateral GSV 2nd best (if contralateral ABI > 0.6)
- Vein map alternatives (arm vein >SSV> radial artery >deep vein)
  - Prosthetic graft
  - Human umbilical vein

Graft Type and Study	PATENCY (%)					P Value
	1-Year	2-Year	3-Year	4-Year	5-Year	
<b>Above-Knee Popliteal Bypass: Vein Versus Prosthetic (Polytetrafluoroethylene or Human Umbilical Vein)</b>						
Klinkert et al. <sup>145</sup> (n = 151)						.035
Vein					76	
PTFE					52	
Johnson et al. <sup>147</sup> (n = 752)						.01
Vein		81			73	
HUV		70			53	
PTFE		69			39	
Tilanus et al. <sup>152</sup> (n = 49)						<.001
Vein					70	
PTFE					37	
Veith et al. <sup>153</sup> (n = 845)						
Above-knee popliteal (n = 176)						>.25
Vein				61		
PTFE				38		
Below-knee popliteal (n = 153)						<.05
Vein				76		
PTFE				54		
Infrapopliteal (n = 204)						<.001
Vein				49		
PTFE				12		

**DK Chew, et al.:** Bypass in the absence of ipsilateral greater saphenous vein: safety and superiority of the contralateral greater saphenous vein. *J Vasc Surg.* 35:1085-1092

2002 [PMID: 12042718](https://pubmed.ncbi.nlm.nih.gov/12042718/)



Graft Type and Study	PATENCY (%)					P Value
	1-Year	2-Year	3-Year	4-Year	5-Year	
<b>Polytetrafluoroethylene: Vein Cuff Versus No Cuff</b>						
Stonebridge et al. <sup>121</sup> (n = 261)						
Above-knee popliteal						NS
Cuff	80	72				
No cuff	84	70				
Below-knee popliteal						.03
Cuff	80	52				
No cuff	65	29				

Rutherford Vascular Surgery and Endovascular Therapy 9th Edition (Illustrations)

# Bypass Technique

- Reversed saphenous vein bypass
  - 1st bypass tunnel deep/ anatomic plane
  - Redo bypass tunnel superficial
  - Anterior tibial bypass lateral tunnel vs interosseus tunnel
  - Open vs. Endoscopic Vein harvest
- In-situ technique
  - Requires lysis of valves
  - Decreases incidence of vein mismatch <sup>8</sup>
- Non-reversed transposed saphenous vein bypass

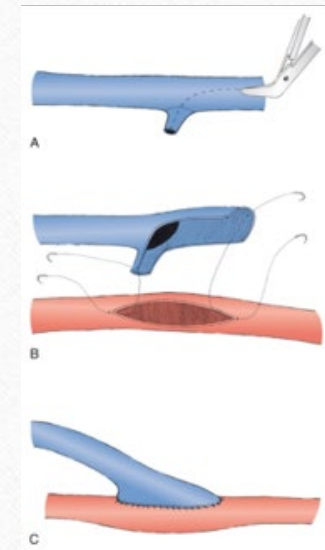
## 8 Endoscopic versus open saphenous vein harvest for femoral to below the knee arterial bypass using saphenous vein graft

Leo M. Gazoni, MD, Rebecca Carty, BS, John Skinner, PA-C, Kenneth J. Cherry, MD, Nancy L. Harthun, MD, Irving L. Kron, MD, Curtis G. Tribble, MD, and John A. Kern, MD, Charlottesville, Va

*Conclusion:* Despite our initial concerns of damaging the venous conduit with a minimally invasive approach to saphenous vein harvest, EVH in our experience has resulted in a trend toward improved patency rates and decreased infectious wound complications while affording the benefit of improved cosmesis. An endoscopic approach results in smaller incisions, decreased interventions for occlusion, and improved outcomes compared with OVH. EVH is the procedure of choice for harvesting saphenous vein for femoral to below the knee arterial bypass surgery. (J Vasc Surg 2006;44:282-8.)



MC Donaldson, et al.: Femoral-distal bypass with in situ greater saphenous vein. Long-term results using the Mills valvulotome. *Ann Surg.* 213:457-464 1991 PMID: 2025066



# Intraoperative Assessment



- Doppler assessment with compression of the bypass
- Routine completion angiography
- Completion duplex

Contribution of routine intraoperative completion arteriography to early infrainguinal bypass patency \*

MD Joseph L. Mills<sup>1</sup>, MD Roy M. Fujitani<sup>1</sup>, MD Spence M. Taylor<sup>1</sup>

The American Journal of Surgery

Volume 164, Issue 5, November 1992, Pages 506-511

- Prospective study 214 bypasses
- 8% abnormal angio requiring intervention (revision distal anastomosis, distal clot, bypass compression or twist)

# Thank You!

---

Rutherford Vascular Surgery and Endovascular Therapy 9th Edition (Illustrations)

Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *J Vasc Surg.* 2007;45 Suppl S:S5-67.

Dormandy JA, Rutherford RB. Management of peripheral arterial disease (PAD). TASC Working Group. TransAtlantic Inter-Society Consensus (TASC). *J Vasc Surg.* 2000;31(1 Pt 2):S1-S296

Pomposelli FB, Jepsen SJ, Gibbons GW, et al. Efficacy of the dorsal pedal bypass for limb salvage in diabetic patients: short-term observations. *J Vasc Surg.* 1990;11(6):745-51; discussion 751-2.

Tweedie JH, Ballantyne KC, Callum KG. Direct arterial pressure measurements during operation to assess adequacy of arterial reconstruction in lower limb ischaemia. *Br J Surg.* 1986;73(11):879-81.

Mills JL, Taylor SM, Fujitani RM. The role of the deep femoral artery as an inflow site for infrainguinal revascularization. *J Vasc Surg.* 1993;18(3):416-23.

Veith FJ, Gupta SK, Samson RH, Flores SW, Janko G, Scher LA. Superficial femoral and popliteal arteries as inflow sites for distal bypasses. *Surgery.* 1981;90(6):980-90.

Veith FJ, Ascher E, Cayne NS. Unusual surgical exposures to avoid scarred or infected standard access routes to the common femoral, deep femoral and popliteal arteries. *J Vasc Surg.* 2016;64:1160-8



## References

---

Ouriel K. Posterior exposure for popliteal-crural bypass: a useful approach. *Semin Vasc Surg.* 1997;10(1):23-30.

<https://thoracickey.com/plantar-and-tarsal-artery-reconstructions/>

Chew DK, Owens CD, Belkin M, et al. Bypass in the absence of ipsilateral greater saphenous vein: safety and superiority of the contralateral greater saphenous vein. *J Vasc Surg.* 2002;35(6):1085-92.

Donaldson MC, Mannick JA, Whittmore AD. Femoral-distal bypass with in situ greater saphenous vein. Long-term results using the Mills valvulotome. *Ann Surg.* 1991;213(5):457-64; discussion 464-5.

Gazoni LM, Carty R, Skinner J, Cherry KJ, Harthun NL, Kron IL, Tribble CG, Kern JA.

Endoscopic versus open saphenous vein harvest for femoral to below the knee arterial bypass using saphenous vein graft. *J Vasc Surg* 2006;44:282-8.

Mills JL, Fujitani RM, Taylor SM. Contribution of routine intraoperative completion arteriography to early infrainguinal bypass patency. *Am J Surg.* 1992;164(5):506-10; discussion 510-1.