


Which Patients With CLTI Should Be Treated Primarily With A Heparin Bonded PTFE Graft And Why: How Can An Amputation-Free Survival Score Be Helpful
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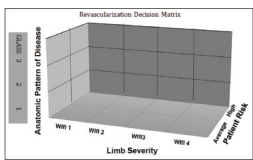
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Evidence based revascularization: decision-making for BTK lesions

PLAN

- Patient risk
- Limb threat severity
- Anatomic pattern



(Conte M et al, ESVS-SVS Clinical Practice Guidelines, 2019)

6.32 In average-risk CLTI patients with infrainguinal disease, base decisions of endovascular intervention vs open surgical bypass on the severity of limb threat (eg, WII), the anatomic pattern of disease (eg, GLASS), and the availability of autogenous vein.

Grade	Level of evidence	Key references
I (Strong)	C (Low)	Almstny, 2016

6.37 Consider open surgery in selected high-risk patients with advanced limb threat (eg, WII stage 3 or 4), significant perfusion deficits (ischemic grade 2 or 3), and advanced complexity of disease (eg, GLASS stage III) or after prior failed endovascular attempts and unresolved symptoms of CLTI.

Grade	Level of evidence	Key references
II (Weak)	C (Low)	

CLTI: which is the best option?

BASIL 1

BASIL 2

BEST-CLI

PRO-CLI

Open surgery

Endo-first strategy

Open surgery

Open surgery

Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial. The outcomes in terms of AFS are similar between the two methods in the short term; however, in patients with a life expectancy of at least 2 years, bypass surgery has a lower rate of reintervention. (Adami DJ, et al., Lancet 2005)

A vein bypass first versus a best endovascular treatment first revascularisation strategy for patients with chronic limb-threatening ischaemia who required an infra-popliteal, with or without an additional more proximal infra-inguinal revascularisation procedure to restore limb perfusion (BASIL-2): endovascular treatment shows greater amputation-free survival and lower mortality in patients with CLTI who require an infra-popliteal procedure, with or without additional proximal revascularization. (Bradbury AW, et al. Lancet 2023)

Surgery or Endovascular Therapy for Chronic Limb-Threatening Ischemia: In patients with an adequate great saphenous vein, the incidence of M.A.L.E. and death was significantly lower in the surgical group compared to the endovascular group. In patients with an inadequate saphenous vein, the outcomes in the two groups were similar. (Farber A, et al. NEJM 2022)

Editor's Choice: Infra-inguinal Endovascular Revascularization and Bypass Surgery for Chronic Limb-Threatening Ischaemia: a Retrospective European Multicentre Cohort Study with Propensity Score Matching: Bypass surgery offers a greater AFS and wound healing compared to endovascular therapy. (Rico JB, et al. EMS 2023)

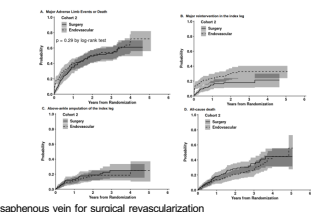
Surgery or Endovascular Therapy for Chronic Limb-Threatening Ischemia

BEST-CLI
THE NEW ENGLAND JOURNAL OF MEDICINE
November 7, 2022

COHORT 1

COHORT 2

22% of patients needed alternative conduit



CONCLUSIONS
Among patients with CLTI who had an adequate great saphenous vein for surgical revascularization (cohort 1), the incidence of a major adverse limb event or death was significantly lower in the surgical group than in the endovascular group. Among the patients who lacked an adequate saphenous vein conduit (cohort 2), the outcomes in the two groups were similar.

(Farber A, et al. NEJM 2022)

The BEST-CLI Trial: Time for Pause or Action?

In terms of the trial bypass experience, there was not an obvious difference in primary endpoint analysis between the surgical groups in Cohort 1 vs Cohort 2 (42.6% vs 42.8%, respectively). Although vein bypass grafts are considered to result in superior results as compared with prosthetic grafts, the trial did not report a significant difference noted in Cohort 2. Prosthetic graft performance has greatly improved with the addition of heparin bonding and anastomotic adjuncts approaching vein graft performance.⁴³ However, the primary endpoint was not meant to evaluate graft performance, but this is certainly an area for further analysis.

Autologous great saphenous vein
Alternative conduits

(Saab et al., Journal of CLI 2023)

A Systematic Review and Meta-Analysis of Heparin-Bonded Expanded Polytetrafluoroethylene Grafts for Below-The-Knee Femoral Bypass Surgery

Yann Gaußig,¹ Gabriele Piffaretti,² Kaifeng Ishak,³ Bernhard Derwallen⁴ and Alexander Hylthé-Dürn,¹ Paris, France, and Varese, Italy, and Livingston, Scotland, and Mainz and Augsburg, Germany

Ann Vasc Surg. 2024 Aug;10(2):236-251. doi: 10.1016/j.avsg.2024.01.022.

Results	1452		
Primary patency	78.9% (1y)	88.2 (2y)	48.0% (5y)
Secondary patency	84.8 (1y)	88.9 (2y)	
Limb rescue	88.3% (1y)	76.9 (3y)	

Conclusion
The present systematic review suggests that the ePTFE conduit is a well-studied synthetic graft and demonstrates acceptable clinical outcomes for the management of BK arterial bypass. Outcome was superior for grafts with a femoropopliteal anastomosis compared to grafts with a femorofemoral anastomosis. Nonetheless, the overall quality of the evidence is low and, for this reason, randomized comparative studies are needed to assess the effectiveness of synthetic grafts in BK surgical bypass, particularly in the mid-to-long-term, where data are very limited. Such studies would be very pertinent for informing clinical decision-making and guidelines.

Autologous saphenous vein and heparin-bonded expanded polytetrafluoroethylene as graft materials for below-the-knee femoro-popliteal bypass in patients with critical limb ischemia: A propensity score-matched analysis

Table 1 - Demographic data, comorbidities, risk factors, clinical and anatomical characteristics in the whole study group and in the two matched groups

	HePTFE group (166 int.)	ASV group (109 int.)	P	Matched HePTFE group (101 int.)	Matched ASV group (101 int.)	P
Female gender	22 (13%)	30 (28%)	0.5	30 (30%)	29 (29%)	0.9
Mean age (years)	73.6 ± 8.2	72.1 ± 12.2	0.2	74.3 ± 8.2	72.1 ± 12.2	0.5
History of smoking	116 (70%)	78 (72%)	0.7	70 (69%)	72 (71%)	0.7
Hypertension	130 (78%)	73 (67%)	0.01	69 (68%)	69 (68%)	1
Arterial hypertension	137 (82%)	85 (78%)	0.09	83 (82%)	83 (82%)	1
Diabetes mellitus	61 (37%)	41 (38%)	0.6	40 (40%)	42 (42%)	0.7
Coronary artery disease	74 (45%)	42 (38%)	0.3	46 (46%)	42 (42%)	0.6
Chronic renal failure	20 (12%)	12 (11%)	0.9	12 (12%)	12 (12%)	0.7
Primary intervention	108 (65%)	67 (62%)	0.5	70 (69%)	71 (70%)	0.2
Presence of ulcers/gangrene	79 (48%)	50 (46%)	0.8	50 (50%)	51 (51%)	1
Less than 2 outflow vessels	64 (39%)	74 (68%)	0.06	63 (63%)	66 (65%)	0.6
Planned limb amputation	21 (13%)	31 (29%)	0.007	21 (21%)	26 (26%)	1
Propensity Aft value	0.21 ± 0.2	0.19 ± 0.19	0.7	0.19 ± 0.19	0.21 ± 0.19	0.7

(Dorigo W, Pratesi C et al. The Surgeon 2021)

Autologous saphenous vein and heparin-bonded expanded polytetrafluoroethylene as graft materials for below-the-knee femoro-popliteal bypass in patients with critical limb ischemia: A propensity score-matched analysis

Table 5 - Follow-up outcomes on the basis of the level of the distal anastomosis in the matched groups

Outcome at 5 years	Survival	Primary patency	Assisted primary patency	Secondary patency	Limb salvage	AFS
BK bypass						
- HePTFE	71.5%	45%	45%	62%	77%	56%
- ASV	74%	50%	50%	59%	80%	60%
P	0.9	0.7	0.1	0.6	0.7	0.4
Tibial bypass						
- HePTFE	64%	38%	22%	35%	42%	36%
- ASV	70%	28%	28%	30%	36%	34%
P	0.6	0.7	0.9	0.3	0.8	0.6

Our results continue to support the change in the strategy we adopted in recent years, consisting in the use of the ipsilateral ASV only when of excellent quality and in the preferential use of adjunctive procedures for the run-off improvement along with a well standardized intra and postoperative protocol when HePTFE is chosen.

(Dorigo W, Pratesi C et al. The Surgeon 2021)

Utility of predicting scores

Impact of Comorbidities on Decision-Making in Chronic Critical Limb Ischemia
Andreas Schanzler, MD

Given both the high cost value of the critical limb ischemia (CLI) patient population, as well as the variety of available treatment options, the ability to use prognostic variables to predict a given outcome has become increasingly important. The three most advanced associated with accurate risk stratification include: (1) improved clinical decision-making based on realistic patient and provider expectations; (2) ability to benchmark individual performance and institutions by comparing their outcomes with expected outcomes; (3) the ability to identify patients being treated, and (3) creation of effective performance goals for the evaluation of new treatment modalities in specific patient populations. Patients with CLI have multiple comorbidities that can impact directly on the outcomes of attempted revascularization. The **PIII RISK SCORE** for CRITICAL LIMB ISCHEMIA has been developed as a tool to estimate mid-term limb-free survival of 1 year in patients undergoing open bypass surgery for limb salvage and has now been validated using data from >3000 cases. The score incorporates the baseline clinical variables—diabetes, tissue loss, age, hemoglobin, and coronary artery disease—and assigns patients into three distinct risk groups. Diabetic in the high-risk subgroup 30.7% of total number of patients evaluated experienced <10% amputation-free survival at 1 year. This tool may be valuable in selecting both the surgeon and patient based on individual decision in CLI.

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PIII RISK SCORE for CRITICAL LIMB ISCHEMIA

Variable	Points
DIALYSIS	4
TISSUE LOSS	3
AGE ≥ 75	2
HCT ≤ 30%	1
CAD	1

0-20 Points: LOW RISK
21-30 Points: MEDIUM RISK
31-40 Points: HIGH RISK

The Comprehensive Risk Assessment for Bypass (CRAB) facilitates efficient perioperative risk assessment for patients with critical limb ischemia

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Comorbidity	Points	OR (95% CI)	P
Age >75 years	3	1.885 (1.088-3.264)	0.08
Prior amputation /revascularization	3	1.425 (1.121-1.812)	0.04
Claudication (vs rest pain)	3	1.477 (1.1-1.988)	0.08
Partial functional dependence	3	1.675 (1.291-2.174)	<0.001
Dependence	4	2.083 (1.526-2.842)	<0.001
Hemoglobin	4	2.236 (1.484-3.44)	<0.001
Emergency case	6	2.261 (1.708-3.009)	<0.001
Total functional dependence	6	3.233 (2.731-6.039)	<0.001

CI, Confidence Interval; MI, myocardial infarction; OR, odds ratio.

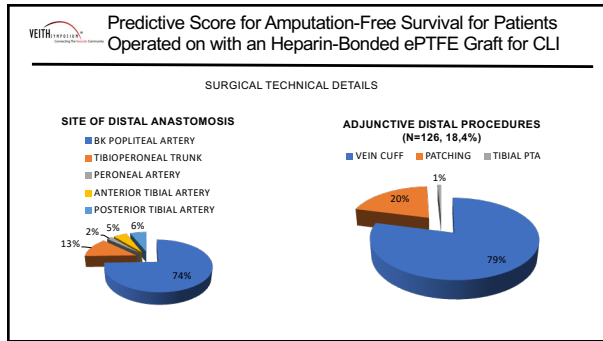
Vascular Surgery
JOURNAL OF VASCULAR SURGERY
May 2013

Predictive Score for Amputation-Free Survival for Patients Operated on with an Heparin-Bonded ePTFE Graft for CLI

DEMOGRAPHIC DATA, COMORBIDITIES AND RISK FACTORS

SEX: MALE (170), FEMALE (513)

MEAN AGE 73.9 yrs



Predictive Score for Amputation-Free Survival for Patients Operated on with an Heparin-Bonded ePTFE Graft for CLI

DEFINITIONS FOR COVARIATE INCLUDED IN UNIVARIATE ANALYSIS FOR 5-YEAR AFS

Covariate	Definition
Gender	Male or female patients
Older age	Patient age 75 or more
Reintervention	Intervention performed in a previously operated leg (open or endovascular)
Diabetes Mellitus	Need for specific antidiabetic drug
History of Ischemic Heart Disease	Prior Myocardial Infarction or surgical or percutaneous revascularisation
Hyperlipemia	Hyperlipemia in medical treatment
Arterial Hypertension	Hypertension in medical treatment
End-stage Renal Disease	Patients on dialysis
Clinical Status	Presence of breast pain or tissue loss
Level of anastomosis	Distal anastomosis at popliteal or tibial level
Distal procedure	Use of adjunctive procedure at distal anastomotic site
Run-off	Number of patent outflow vessel assessed by the preoperative imaging

Predictive Score for Amputation-Free Survival for Patients Operated on with an Heparin-Bonded ePTFE Graft for CLI

UNIVARIATE ANALYSIS FOR 5-YEAR AFS

	Amputation-Free Survival (%)	Sample Size	P
Age (years)	72	203	<0.001
Gender	73	73	0.807
Older age	65	65	0.4
History of smoking	65	65	0.4
Hypertension	67	67	0.4
Hyperlipemia	68	68	0.1
Ischemic Heart Disease	67	67	<0.001
Diabetes	73	73	0.1
End-stage Renal Disease	68	68	<0.001
Arterial Hypertension	68	68	0.7
End-stage Renal Disease	68	68	<0.001
Level of anastomosis	68	68	<0.001
Distal procedure	68	68	0.08
Run-off (score)	68	68	<0.001
Run-off (score)	68	68	<0.001

Predictive Score for Amputation-Free Survival for Patients Operated on with an Heparin-Bonded ePTFE Graft for CLI

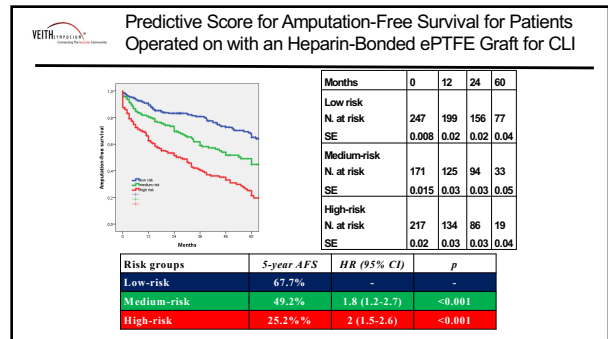
MULTIVARIATE ANALYSIS FOR 5-YEAR AFS

	95% CI	HR	P	B-coefficient	Integer Score
Age > 75 years	1.1-1.7	1.3	0.01	0.305	1
Ischemic Heart Disease	1.1-1.8	1.4	0.001	0.385	2
End-stage renal disease	1.8-4.4	2.8	<0.001	1.045	4
Tissue loss	1.3-2.2	1.8	<0.001	0.547	2
Run-off score 0-1	1.4-2.3	1.8	<0.001	0.590	2

Predictive Score for Amputation-Free Survival for Patients Operated on with an Heparin-Bonded ePTFE Graft for CLI

PROPOSED RISK SCORE		ESTIMATED 5-YEAR AFS ON THE BASIS OF THE ASSIGNED SCORE	
	Yes	No	
Age ≥ 75 yrs.	1 pt.	0 pt.	Scores (n. of patients)
CAD	2 pts.	0 pt.	5-year AFS
ESRD	4 pts.	0 pt.	0 (80 patients) 79.5%
Tissue loss	2 pts.	0 pt.	1 (39 patients) 63.4%
Poor run-off	2 pts.	0 pt.	2 (132 patients) 62.3%
			3 (81 patients) 43.8%
			4 (97 patients) 45.3%
			5 (100 patients) 26.4%
			6 (51 patients) 22%
			7 (76 patients) 19%
			8 (6 patients) 13%
			9 (5 patients) 0

Risk groups	score
Low-risk	0-2
Medium-risk	3-4
High-risk	5-11



What's next?
Prospective validation of the risk score

- Multicentric study
- Prospective enrollment of the patients
- Preoperative score calculation
- Patients with ≤ 4 points: HePTFE (independently from the presence of a suitable autologous saphenous vein)
- Study power 85%, alpha coefficient 5%: 350 patients

