Indocyanine Green Angiographic Criteria Using Ingress and Ingress Rate to Detect SVS Lower Extremity Threatened Limb Classification (WIfI) Grade 3 Ischemia

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Objective: The evaluation of patients presenting with foot wounds and a spectrum of ischemia has grown more complex. Traditional means of assessing whether blood flow is sufficient for healing are increasingly limited by medial calcinosis, prior toe amputations, and open wounds. We therefore sought to define the utility of indocyanine green angiography (ICGA) as an alternative, objective perfusion assessment not subject to such limitations.

Methods: ICGA uses a charge-coupled camera, a laser, and intravenous contrast to assess skin perfusion. From January 2011 to December 2013, we performed ICGA within 5 days of 57 revascularization procedures in patients with ischemia and tissue loss. Ankle-brachial indices (ABIs) and toe pressures, when available, were compared with multiple, quantitative aspects of ICGA.

Results: A total of 46 patients underwent 57 revascularization procedures (44 endovascular, 11 open, and 2 hybrid) for 48 lower limb wounds (WIfI wound classes 1, 2, and 3 in 32.6%, 52.2%, and 15.2%, respectively); 85% were diabetic, and 24% were dialysis-dependent. The Society for Vascular Surgery (SVS) ischemia classification was not possible in one-third of cases due to the inability to obtain standard measurements (65% incompressible ABIs, 41% unable to measure toe pressures). We performed ICGA in all patients and analyzed multiple parameters; ingress (increase in pixel strength [PxS]) and ingress rate (slope of increase in PxS) both significantly correlated with available ABIs ($P < .05$). An ingress of 27.3 PxS and ingress rate of 1.1 PxS/s corresponded to an ABI of 0.4, the cutoff for SVS WIfI ischemia grade 3. After revascularization, 80% of patients had ingress ≥27.3 PxS, 85% had ingress rates ≥1.1 PxS/s, and 100% of those with compressible ABIs postoperatively had an ABI ≥0.4.

Conclusions: ICGA provides quantitative information about foot perfusion even for patients in whom traditional noninvasive measurements cannot be obtained. We believe this report is the first to define specific ICGA parameters for detecting severe ischemia (WIfI ischemia grade 3) in predominantly diabetic patients with foot wounds and correlating them with standard noninvasive studies. Further study is warranted to refine the use of this technology to appropriately select patients for revascularization and predict wound healing.

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Intraoperative Completion Imaging Does Not Improve Primary Patency for Lower Extremity Bypass: A Vascular Quality Initiative Analysis

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Objective: This study was conducted to determine the influence of intraoperative completion imaging (CI) for lower extremity vein bypass (LEB) to a below-knee target on primary patency in the Vascular Quality Initiative (VQI).

Methods: The VQI database was queried from January 2003 to October 2013 for LEBs that were elective, had an indication of occlusive disease, used a single-segment great saphenous vein conduit, and had a below-knee target. LEBs with concomitant endovascular procedures were excluded. CI was defined as completion angiography and/or duplex. The end points were primary patency at discharge and at 1 year.

Results: During the study period, 14,284 LEBs were performed, of which 3151 satisfied the inclusion/exclusion criteria. A total of 1457 (46%) underwent CI: 287 duplex studies (20%), 1116 angiograms (77%) , and 54 both (3.7%). More patients in the CI group had a history of smoking and bypass graft crossing the knee (Table I). Mean procedure time with CI was 274 minutes vs 244 minutes without CI ($P < .0001$). CI did not influence primary patency at discharge (CI: 93.2% vs no CI: 93.8%; $P = .52$). Discharge primary patency was 95.1% for completion duplex vs 92.8% for completion angiogram ($P = .17$). The 1-year primary patency was 63% in the CI group vs 68% in the no CI group ($P = .051$). The 1-year primary patency was 60% for completion duplex vs 65% for completion angiogram ($P = .61$). On univariate and multivariate analysis, CI did not significantly influence primary patency, although multiple other factors were associated with a loss of primary patency (Table II).

Conclusions: Procedures with intraoperative CI require a mean procedure time of 30 minutes more than procedures without CI. However, CI is not associated with improved discharge or 1-year primary patency of elective LEB grafts with a below-knee target artery performed for occlusive disease.

Table I. Patient characteristics

Variables	*Completion imaging*		P
	Yes (n = 1457)	*No (n = 1694)*	
Age, mean year	66.6	67.2	.12
Male, No. (%)	1031 (71)	1165 (69)	.25
White race, No. (%)	1238 (85)	1393 (82)	.06
Hypertension, No. (%)	1294 (89)	1489 (88)	.57
Diabetes, No. (%)	742 (51)	874 (52)	.65
End-stage renal disease, No. (%)	97 (6.7)	108 (6.4)	.77
Coronary artery disease, No. (%)	458 (31)	478 (28)	.053
History of smoking, No. (%)	1217 (84)	1356 (80)	.02
Previous ipsilateral lower extremity			
Bypass, No. (%)	154 (11)	185 (11)	.73
Endovascular intervention, No. (%)	336 (23)	423 (25)	.2
Tibial/pedal target artery, No. (%)	812 (56)	929 (55)	.67
Graft crossing the knee, No. (%)	1363 (94)	1536 (91)	.005

Table II. Factors associated with loss of primary patency on multivariate analysis

Variable	*OR*	*95% CI*
Discharge primary patency		
Dialysis dependence	1.7	1.1-2.7
Previous ipsilateral lower extremity bypass	1.7	1.1-2.5
Tibial/pedal target	1.6	1.1-2.1
	HR	*95% CI*
One-year primary patency		
Female gender	1.2	1.0-1.5
Previous ipsilateral lower extremity bypass	1.4	1.1-1.8
Previous ipsilateral endovascular intervention	1.3	1.1-1.6
Tibial/pedal target	1.3	1.1-1.5
Graft crossing the knee	1.8	1.2-2.6

CI, Confidence interval; *HR,* hazard ratio; *OR,* odds ratio.

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Presentation of Symptomatic PAD in Patients with Chronic HIV Infection

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Objective: The enhanced longevity of patients living with chronic HIV infection has resulted in an increased burden of chronic diseases. There is growing evidence that HIV-infected patients are at a higher-than-expected risk of coronary artery disease by 1.5 to 2 times. The significance of chronic HIV infection in the peripheral vasculature is largely unknown.

Methods: This was a retrospective analysis of patients with HIV infection referred for initial consultation to vascular surgery clinics at three teaching hospitals over a 3-year period. Records were reviewed for clinical presentation, comorbid conditions, duration of HIV infection, antiretroviral treatment history, and biochemical profile. Imaging studies were reviewed to localize the distribution of atherosclerosis.

Results: Twenty-seven patients (25 men [93%]) with HIV infection were referred for symptoms related to peripheral arterial disease (21 of 27 [78%]) or extracranial cerebrovascular disease (6 of 27 [22%]). The average age was 59.8 years (range, 35-74 years). Traditional atherosclerosis risk factors were present in varying amounts, including hypertension (22 of 27 [81%]), diabetes (8 of 27 [30%]), family history (6 of 27 [22%]), and active smoking (6 of 27 [22%]). The average duration of HIV infection was 18 years (range, 11-30 years). Chronic infection was well controlled (mean current CD4+ cell count, 554; viral load <75 copies/μL in 25 of 27 [93%]). Twenty-six patients were being actively treated with highly active antiretroviral therapy (mean duration, 12.5 years), and 23 of the 26 regimens included a nucleoside/nucleotide reverse transcriptase inhibitor. The distribution of atheroma was diffuse, with the femoropopliteal segment most frequently involved (15 of 27 [56%]), followed by aortoiliac disease (12 of 27 [44%'), infrageniculate disease (9 of 27 [33%]), and carotid bulb disease (6 of 27 [22%]).

Conclusions: Patients with chronic HIV infection can present with clinically significant PAD at a young age. The distribution of disease is