

# Cardiovascular Update

November 2018 | Volume 3, Issue 6

A newsletter from the BayCare Cardiovascular Service Line

## The Wound, Ischemia and Foot Infection Classification in Diabetic Limb Salvage

Susan Shafii, MD, RPVI, FACS

Atherosclerosis remains the leading cause of mortality in the United States. The systemic effects of atherosclerosis have been well described in vascular surgery literature. The impacts of peripheral vascular disease on quality of life and overall mortality are a marker of the epidemic. The definition of critical limb ischemia in peripheral vascular disease was first published in 1982, as an ankle pressure <40mmHg in rest pain patients and ankle pressure < 60mmHg in the presence of tissue necrosis.<sup>1,2</sup> Of note, the patients specifically excluded from this definition were diabetics, as they carry a mixed picture of neuropathy, ischemia and sepsis.<sup>2</sup> At present, the five-year mortality in patients with critical limb ischemia is 50-60 percent, with stroke and coronary events accounting for greater than 70 percent of the deaths.<sup>1,4-9</sup> According to the Centers for Disease Control and Prevention, there are 30.3 million Americans, or 9.4 percent of the U.S. population, living with diabetes, and another 84.1 million Americans with prediabetes.<sup>3</sup> In addition, there were 108,000 hospital discharges for lower extremity amputation and diabetes in 2014.<sup>3</sup>

The traditional classification scheme for the management and guidance of vascular patients has been the Rutherford classification and TASC II guidelines. The Rutherford classifications for chronic limb ischemia have six categories, and are oriented around presenting symptoms such as claudication and tissue loss. The TASC II guidelines are centered around management of disease based on anatomic length and location of vascular atherosclerotic disease. Neither incorporates the diabetic patient with active infection, atherosclerotic disease and neuropathy. In 2014, the new Society of Vascular Surgery (SVS) Lower Extremity Threatened Limb Classification based on the Wound, Ischemia and foot Infection (WIFI) risk stratification was published and launched by the SVS Lower Extremity Guidelines Committee to tackle this widening issue within the vascular population. In regard to diabetic foot ulcers (DFU), the three main causes are neuropathic, ischemic and neuroischemic. Traditionally, DFUs have been neuropathic; however, with the increasing incidence of both diabetes and peripheral vascular disease in the U.S., the incidence of DFUs due to neuroischemia is over 50 percent.<sup>1</sup>



As a system of community hospitals in West Central Florida, BayCare is committed to being a leader in providing superior heart care. The BayCare Cardiovascular and Surgical Outcomes book for 2017 is

available, detailing our volume and outcomes data as well as highlighting some of our world-class programs including our heart failure clinics, fast-growing structural heart and arrhythmia programs, and the many clinical research trials available across the system. Download a copy of our 2017 outcomes book today.



**Susan Shafii, MD, RPVI, FACS**

Medical Director, Complex Vascular Services,  
Morton Plant Mease

The Wound, Ischemia and foot Infection (WIFI) classification is similar to the TNM cancer staging system. The patient should be staged at initial presentation, and after debridement and/or revascularization. The wound category is based on size, severity, depth of wound and complexity, and ability to heal the wound. The wounds are graded from 0-3. The ischemia category is also graded 0-3, and is based primarily on ankle-brachial index (ABI), ankle systolic pressure, toe pressure (TP) and transcutaneous oxygenation (TC-O<sub>2</sub>). An ABI of >0.8 is graded a 0, as these patients likely don't require revascularization to heal their wounds and are thus at a lower risk of amputation.<sup>1</sup> A grade 3 would be a patient with an ABI of <0.4, in which revascularization is required to achieve wound healing and has a high risk of amputation. An ABI between 0.4-0.8 will be graded either a 1 or 2, and is based on TCO<sub>2</sub> or TPs, as the

*Continued on page 2*



ABIs will be unreliable in diabetic patients. In addition, especially in the diabetic patient, this intermediate perfusion phase is extremely important to identify proper perfusion to achieve limb salvage. The foot infection category incorporates the Infectious Disease Society of America (IDSA) classification. It's well known that the risk of amputation directly correlates with the increasing infection severity, and that in the diabetic population, infection is the major factor that prompts hospitalization, leads to amputation, and when combined with PVD, markedly increases the risk of amputation<sup>1,10</sup> (see Table I).

**Table I**

Wound grade		Ischemia grade <sup>a</sup>		Infection grade	
0	No wound	0	TP >60 mm Hg ABI >0.8 ASP >100 mm Hg	0	No symptoms or signs of infection
1	Small, shallow ulcer No exposed bone, unless limited to distal phalanx No gangrene	1	TP 40-59 mm Hg ABI 0.6-0.79 ASP 70-100 mm Hg	1	Local infection involving only skin and the subcutaneous tissue
2	Deeper ulcer with exposed bone, joint, or tendon, not involving tissue heel Shallow heel ulcer without calcaneal involvement Gangrene limited to digits	2	TP 30-39 mm Hg ABI 0.4-0.59 ASP 50-70 mm Hg	2	Local infection with erythema >2 cm or involving structures deeper than skin and subcutaneous tissues (eg, abscess, osteomyelitis)
3	Extensive, deep ulcer involving forefoot/midfoot Deep, full-thickness heel ulcer and/or calcaneal involvement Extensive gangrene involving forefoot/midfoot Full-thickness heel necrosis and calcaneal involvement	3	TP <30 mm Hg ABI <0.39 ASP <50 mm Hg	3	Local infection with signs of SIRS

ABI, Ankle-brachial index; ASP, ankle systolic pressure; SIRS, systemic inflammatory response syndrome; TP, toe pressure.  
<sup>a</sup>WIFI classification system suggests that depth of wound take priority over size of wound.  
<sup>b</sup>If ABI and TP result in different grades, TP is recommended to determine grade.

SVS WIFI Classification. The three categories are wound, ischemia and foot infection. Each limb will be given a grade of 0–3 from each category. \*\*TP – toe pressure; ABI – ankle-brachial index; ASP – ankle systolic pressure. \*\*Taken from Leithead et al.<sup>11</sup>

**Table II**

a. Estimate risk of amputation at 1 year for each combination

	Ischemia – 0				Ischemia – 1				Ischemia – 2				Ischemia – 3											
	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3								
VL	VL	VL	VL	M	VL	L	M	H	L	L	M	M	H	M	M	H	L	L	M	M	H	H	H	H
VL	VL	VL	L	M	VL	L	M	H	L	L	M	M	H	M	M	H	L	L	M	M	H	H	H	H
L	L	M	H	H	M	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H	H	H	H	
M	M	H	H	H	M	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H	H	H	H	
f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-1	f-2	f-3	f-0	f-1	f-2	f-3		

b. Estimate likelihood of benefit of/requirement for revascularization (assuming infection can be controlled first)

	Ischemia – 0				Ischemia – 1				Ischemia – 2				Ischemia – 3										
	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3	W-0	W-1	W-2	W-3							
VL	VL	VL	VL	M	VL	L	M	H	L	L	M	M	H	M	M	H	L	L	M	M	H	H	H
VL	VL	VL	L	M	VL	L	M	H	L	L	M	M	H	M	M	H	L	L	M	M	H	H	H
L	L	M	H	H	M	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H	H	H	
M	M	H	H	H	M	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H	H	H	
f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-0	f-1	f-2	f-3	f-1	f-2	f-3	f-0	f-1	f-2	f-3	

fI, foot Infection; I, Ischemia; W, Wound.

Premises:

- Increase in wound class increases risk of amputation (based on PEDIS, UT, and other wound classification systems)
- PAD and infection are synergistic (Eurodiale); infected wound + PAD increases likelihood revascularization will be needed to heal wound
- Infection 3 category (systemic/metabolic instability): moderate to high-risk of amputation regardless of other factors (validated IDSA guidelines)

Four classes: for each box, group combination into one of these four classes

Very low = VL = clinical stage 1
Low = L = clinical stage 2
Moderate = M = clinical stage 3
High = H = clinical stage 4
Clinical stage 5 would signify an unsalvageable foot

Clinical applications of limb salvage based on WIFI. The patient's grade from each category is plotted on one of the appropriate charts.

- The risk of amputation based on the combination of the three category grades
  - The need for revascularization if the foot infection is controlled
- \*\*Taken from Mills et al.<sup>1</sup>

improve ischemia. They also noted that the one-month WIFI wound and foot infection grades did correlate with amputation-free survival.<sup>11</sup>

In conclusion, the new SVS WIFI classification provides a staging system for the increasing diabetic population with PVD to guide amputation risk and need for revascularization. The WIFI classification incorporates the severity of foot infection and

complexity of the wound along with the ischemia component to the limb. New studies demonstrate that one-month and six-month restaging identifies high-risk patients that may be worth re-intervention to avoid limb loss.<sup>11</sup>

## References

- Mills JL, Conte MS, et al. The Society of Vascular Surgery Lower Extremity Threatened Limb Classification System: Risk stratification based on the Wound, Ischemia and foot Infection (WIFI). *Journal of Vascular Surgery*. January 2014; 59(1): 220-234.
- Bell PRF, Charlesworth D, DePalma RG, Eastcott HHG, Eklöf B, Jamieson CW, et al. The definition of critical ischemia of a limb. Working Party of the International Vascular Symposium. *Br J Surg* 1982;69 (Suppl):S2.
- National Diabetes Statistic Report 2017. Centers for Disease Control. <https://www.cdc.gov/media/releases/2017/p0718-diabetes-report.html>
- Criqui MH. Peripheral arterial disease and subsequent cardiovascular mortality: a strong and consistent association. *Circulation* 1990;82: 2246-7.
- Caro J, Migliaccio-Walle K, Ishak KJ, Proskorovsky I. The morbidity and mortality following a diagnosis of peripheral arterial disease: long-term follow up of a large database. *BMC Cardiovasc Disord* 2005;5:14.
- Brownrigg JRW, Davey J, Hoilt PJ, Davis WA, Thompson MM, Ray KK, et al. The association of ulceration of the foot with cardiovascular and all-cause mortality in patients with diabetes: a meta-analysis. *Diabetologia* 2012;55:2906-12.
- Criqui MH, Langer RD, Fronck A, Feigelson HS, Klauber MR, McCann TJ, et al. Mortality over a period of 10 years in patients with peripheral arterial disease. *N Engl J Med* 1992;326:381-6.
- McDermott MM, Feinglass J, Slavensky R, Pearce WH. The ankle-brachial index as a predictor of survival in patients with peripheral arterial disease. *J Gen Intern Med* 1994;9:445-9.
- McGrath MA, Graham AR, Hill DA, Lord RSA, Tracy GD. The natural history of chronic leg ischemia. *World J Surg* 1983;7:314-8.
- Armstrong DG, Lavery LA, Harkless LB. Validation of a diabetic wound classification system. The contribution of depth, infection, and ischemia to risk of amputation. *Diabetes Care* 1998;21:855-9.
- Leithead C, et al. Importance of postprocedural Wound, Ischemia and foot Infection (WIFI) restaging in predicting limb salvage. *Journal of Vascular Surgery*. 2018; 67(2): 498-505. <https://doi.org/10.1016/j.jvs.2017.07.109>

