ASK THE EXPERTS

# Which CLI/CLTI Grading Systems Are You Using When, and Why?

Perspectives on classification and grading systems, their strengths and limitations, and how they are used in current practice.

**By Shipra Arya, MD, SM, FACS; Michael S. Conte, MD; Vickie Driver, DPM; and Thomas Zeller, MD**

**Shipra Arya, MD, SM, FACS**
Associate Professor of Surgery
Division of Vascular Surgery
Stanford University School of Medicine
Stanford, California
Chief-Vascular Section
Palo Alto VA Healthcare System
Palo Alto, California
sarya1@stanford.edu
*Disclosures: None.*

Critical limb ischemia (CLI)/chronic limb-threatening ischemia (CLTI) is a severe presentation of peripheral artery disease (PAD) with hallmark findings of ischemic rest pain, gangrene, or lower limb ulcerations. Given the nature of CLI/CLTI presentation along with concomitant comorbidities such as diabetes, chronic kidney disease, polyvascular disease, neuropathy, and heart failure, patients often present with compounding of ischemia with infection and tissue loss. Infection and tissue loss are important considerations, as the goal of limb salvage is not only to preserve the limb but also to return to a functional quality of life and ambulation. My go-to system for CLI/CLTI grading is the wound, ischemia, and foot infection (WIfI) system because it considers all these aforementioned factors.

The WIfI classification was created by the Society for Vascular Surgery (SVS) Lower Extremity Guidelines Committee as a risk stratification tool to overcome the limitations of the Rutherford and Fontaine classification systems.[1] Although these systems are good at identifying CLI/CLTI (ie, Rutherford class 4-6, Fontaine III-IV), they are not able to further stratify patient risk of limb loss or identify treatment strategies. In the WIfI system, wound, ischemia and foot infection components are each graded on a scale from 0 to 3 (0 = none, 1 = mild, 2 = moderate, and 3 = severe). The aggregate score from these three components (64 possible combinations) are then assigned a clinical stage to correlate with the risk of amputation, with stage 1 being very low, stage 2 being low, stage 3 being moderate, and stage 4 being high.

The benefits of the WIfI system lie in the ability to identify the granular risk for limb loss in this heterogenous group of CLI/CLTI presentation. The tissue loss and infection issues are given equal weight as ischemia because they often dictate the adjunct procedures needed, as well as the time to wound healing and ambulation despite achieving adequate perfusion. It also provides guidance on the benefit or need for revascularization to achieve limb salvage. Furthermore, as multidisciplinary team approaches to limb salvage increase, WIfI provides a common vocabulary for all team members, including surgeons, interventionalists, podiatrists, foot and ankle surgeons, infectious disease specialists, and wound care experts. However, the WIfI is a complex classification scheme that requires a decision aid figure/reference to routinely use in practice and documentation in the electronic health record (EHR) to help providers calculate the stage. An SVS-sponsored mobile app–based risk calculator has been developed for ease of use. The system is also cumbersome and tailored to providers and does not lend itself to use in shared decision-making with patients.

The WIfI system has been studied extensively since its publication, and multiple studies have shown an association with risk of amputation at 1 year, wound healing, and survival.[2-5] It's the most comprehensive scoring system to date that includes the three main factors that predict limb salvage. Future efforts could make it more inclusive for use by patients and in shared decision-making aids, as well as for integration with EHR systems.

1. Mills JL Sr, Conte MS, Armstrong DG, et al. The Society for Vascular Surgery lower extremity threatened limb classification system: risk stratification based on wound, ischemia, and foot infection (WIfI). J Vasc Surg. 2014;59:220-234.e1-2. doi: 10.1016/j.jvs.2013.08.003.
2. Robinson WP, Loretz L, Hanesian C, et al. Society for Vascular Surgery Wound, Ischemia, foot Infection (WIfI) score correlates with the intensity of multimodal limb treatment and patient-centered outcomes in patients with threatened limbs managed in a limb preservation center. J Vasc Surg. 2017;66:488-498.e2. doi: 10.1016/j.jvs.2017.01.063
3. Mathioudakis N, Hicks CW, Canner JK, et al. The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification system predicts wound healing but not major amputation in patients with diabetic foot ulcers treated in a multidisciplinary setting. J Vasc Surg. 2017;65:1698-1705.e. doi: 10.1016/j.jvs.2016.12.123
4. Hicks CW, Canner JK, Mathioudakis N, et al. The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification independently predicts wound healing in diabetic foot ulcers. J Vasc Surg. 2018;68:1096-1103. doi: 10.1016/j.jvs.2017.12.079
5. Van Haelst ST, Teraa M, Moll FL, et al. Prognostic value of the Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification in patients with no-option chronic limb-threatening ischemia. J Vasc Surg. 2018;68:1104-1113.e1. doi: 10.1016/j.jvs.2018.02.028

**Michael S. Conte, MD**
Professor and Chief
Division of Vascular & Endovascular Surgery
University of California San Francisco
San Francisco, California
michael.conte2@ucsf.edu
*Disclosures: Consultant to Abbott Vascular.*

The global vascular guidelines stress the importance of staging in CLTI to optimize treatment outcomes and better compare results. The assessment of Patient risk, Limb threat, and ANatomy of vascular disease—also known as the PLAN framework—emphasizes a structured approach to CLTI management.[1] There are multiple patient risk tools available, none of which is prospectively validated in an all-comer CLTI population. In my practice, I use the published SVS Vascular Quality Initiative CLTI risk calculator to estimate perioperative and 2-year mortality.[2]

The SVS WIfI classification system is broadly applicable to CLTI and has been validated for stratifying amputation risk in numerous reports.[3] The WIfI is similar to the TNM classification system for cancer in that it is both intuitive and clinically relevant. The free downloadable calculator from the SVS interactive practice guideline mobile app makes it simple. In my practice, we stage all patients in our limb preservation centers using WIfI at presentation and to assess treatment center response over time. WIfI stage 4 disease denotes the highest risk of amputation (1-year major amputation rate, 20%-40%),[4] and thus, we fast-track those patients, generally with immediate hospitalization, aggressive control of infection, and prompt revascularization to avoid further tissue loss.

Anatomic staging of disease in CLTI remains a challenge due to the broad topography and lesion complexity encountered. Systems that focus on individual segments such as TransAtlantic Inter-Society Consensus (TASC) are useful for assessing lesion-specific device performance but are limited in clinical decision-making because many CLTI patients present with multisegment disease. The Global Limb Anatomic Staging System (GLASS) provides a new approach that integrates the complexity of a selected target artery pathway from groin to foot.[1,5] WIfI is similar to the SYNTAX score in coronary disease. Lesion location, severity, and length are graded for both above-the-knee and infrapopliteal segments, and the various combinations then yield three overall GLASS stages. Again, there is a free downloadable mobile app for rapid calculation. An important limitation in the current version is that pedal anatomy is not incorporated into the staging. More prospective data are needed to validate and refine GLASS, but early reports have demonstrated its utility to stratify interventional outcomes such as technical success and limb-based patency.

1. Conte MS, Bradbury AW, Kolh P, et al. Global vascular guidelines on the management of chronic limb-threatening ischemia. J Vasc Surg. 2019;69:3S-125S.e40. doi: 10.1016/j.jvs.2019.02.016
2. Simons J, Schanzer A, Flahive JM, et al. Survival prediction in patients with chronic limb-threatening ischemia who undergo infrainguinal revascularization. J Vasc Surg. 2019;69:137S-151S.e3. doi: 10.1016/j.jvs.2018.08.169
3. Mills JL, Conte MS, Armstrong DG, et al. The Society for Vascular Surgery lower extremity threatened limb classification system: risk stratification based on wound, ischemia, and foot infection (WIfI). J Vasc Surg. 2014;59:220-234. doi: 10.1016/j.jvs.2013.08.003
4. van Reijen NS, Ponchant K, Ubbink DT, Koelemay MJW. The prognostic value of the WIfI classification in patients with chronic limb threatening ischemia: a systematic review and meta-analysis. Eur J Vasc Endovasc Surg. 2019;58:362-371. doi: 10.1016/j.ejvs.2019.03.040
5. El-Khoury R, Wu B, Edwards CT, et al. The Global Limb Anatomic Staging System is associated with outcomes of infrainguinal revascularization in chronic limb-threatening ischemia. J Vasc Surg. 2021;73:2009-2020. doi: 10.1016/j.jvs.2020.12.094

**Vickie Driver, DPM**
System Wide Medical Director
Wound Care and Hyperbaric Centers
INOVA Healthcare
Professor
University of Virginia School of Medicine
Charlottesville, Virginia
drvdriver@aol.com
*Disclosures: None.*

There are two main categories of classification systems, anatomic and symptomatic. Of the anatomic classification systems—which include GLASS, TASC, TASC II, angiosome, Bollinger, and Graziani—I primarily use the angiosome classification system. Since 2007, the global consensus has been that the TASC II system is a solely angiographic classification that excludes ischemia and wound criteria and characteristics; therefore, my colleagues and I do not use it. Some of the other classification systems never gained widespread adoption and some were not sufficiently validated.

The angiosome classification system provides perfusion mapping of the lower extremity that helps determine which artery should be prioritized for revascularization based on the location of the wound. I use this system whenever I am treating an ischemic patient with tissue loss and discussing the case with my vascular counterparts. Additionally, the system is a good visual tool to aid in patient education.

The symptomatic classification systems include Fontaine, Rutherford, Wagner, University of Texas (UT), and WIfI. The Fontaine system, which dates to 1954, is a purely ischemic system, sometimes still used in academic settings with vascular or research specialists, and it is the parent to the Rutherford system. I use the Rutherford system as it is one of the most widely recognized ischemic models that is useful in multidisciplinary teams such as those who I work in and with (eg, plastic surgery, infectious disease, vascular specialists). It is especially useful when discussing patients with vascular specialists.

Wagner and UT systems are classification systems specific to diabetic foot ulcers. Wagner is used especially when discussing non-PAD patients. Wagner does not include ischemic criteria; however, it is widely used across disciplines, and grade 2 is a trigger for the use of advanced therapies. Additionally, hyperbaric oxygen therapy indications are associated with Wagner grades. The UT system is better known in the podiatric community but rarely referred to now. I use it only in discussion with those who refer to that system and sometimes in research protocols.

WIfI is the most well-thought-out system and specifically encompasses wound, ischemia, and foot infection. Currently, I find that this classification system is primarily used by highly specialized providers and in research protocols focused on tissue loss and/or PAD. It is more complex than the other systems but is very inclusive of multiple disease states that set up our patients for limb loss. Therefore, I use this more commonly because it allows me to communicate more fully with the team. However, this system still needs widespread adoption and will require incorporation into EHR systems for ease of use. Unfortunately, I don't see it being widely used until it is fully integrated. Overall, it is beneficial in research and in clinical practice because it is a fluid grading system with the patient moving forward and backwards through the continuum of care.

**Thomas Zeller, MD**
Department of Angiology
Universitäts-Herzzentrum
Freiburg-Bad Krozingen
Bad Krozingen, Germany
thomas.zeller@universitaets-herzzentrum.de
*Disclosures: None.*

At my institution, we may not be as up to date on grading systems. We are still using a combination of the Rutherford-Becker classification (RBC) for patients with PAD and the Wagner classification for those with concomitant diabetes mellitus, a classification mainly known and applied in Europe by diabetologists.

The strength of the RBC is that it is an internationally established and well-known classification and easy to understand and apply if Doppler pressures and waveforms are documented. The limitations include the lack of a uniform differentiation between RBC class 5 and 6, as these definitions are dependent on individual standards and experiences with defining which limb is salvageable and which is not. Another limitation is related to patients with diabetes mellitus, arterial disease, and wounds. The system does not allow for differentiation between neuropathic and vascular disease–induced ulcerations. To overcome this second limitation, we combine the RBC and Wagner classifications, allowing us to more specifically describes the wound status of diabetic wounds in terms of wound extension and infection state, especially the involvement of bone and tendon structures. This is somewhat similar to how to the WIfI classification system is used. In addition to classifying the wound, proper photo documentation during every consultation is of utmost importance.

The Wagner classification has a clear description of the wound condition of a primarily diabetic foot wound. However, the grading system does not consider the condition of foot perfusion. As such, this classification essentially needs to be combined with a detailed analysis of foot perfusion, in particular incorporating the angiosome concept. ■