Putting the Vascular Back Into Cardiovascular Research
ST-Segment–Elevation Myocardial Infarction as a Blueprint for Improving Care in Patients With Acute Limb Ischemia

Sreekanth Vemulapalli, MD; Lesley H. Curtis, PhD

Acute limb ischemia is a vascular emergency of the lower extremities characterized by an abrupt loss of limb perfusion that threatens tissue viability and usually presents within 14 days of symptom onset. More than 200,000 patients in the United States were affected by acute limb ischemia in 2000; >1 in 8 underwent in-hospital amputation; and in-hospital mortality approached 10%. Patients with STEMI and acute limb ischemia also are similar, ranging from $14,000 to $23,678 per hospitalization for STEMI and $6000 to $45,000 per hospitalization for acute limb ischemia. Despite these similarities, our understanding of the epidemiology of STEMI and acute limb ischemia require time-critical treatment, and both account for significant cardiovascular morbidity and mortality. Approximately 500,000 STEMs occurred in the United States in 2001 compared with acute limb ischemia in 213,000 patients. Inpatient costs associated with STEMI and acute limb ischemia also are similar, ranging from $14,304 to $23,678 per hospitalization for STEMI and $6000 to $45,000 per hospitalization for acute limb ischemia. Despite these similarities, our understanding of the epidemiology of acute limb ischemia and the impact of evolving systems of care and new interventional techniques on outcomes lags far behind those of STEMI.

Why the lack of attention to an emergent clinical event associated with significant morbidity and mortality? First, vascular disease, both acute and chronic forms, has traditionally suffered from a lack of recognition by providers and patients. Second, the large, comprehensive cardiovascular registries that have made detailed clinical and epidemiological characterization of STEMI possible do not exist for acute lower-extremity arterial disease. Third, administrative claims databases that are often used for foundational descriptive analyses are limited in their ability to characterize nonprocedural arterial disease, and the validity of available diagnostic codes to characterize arterial disease has not been well established.

It is in this setting that Korabathina et al examined 20-year trends in hospitalizations and mortality for lower-extremity arterial thromboembolism. After assessing the sensitivity, specificity, and predictive value of International Classification of Diseases, Ninth Revision, Clinical Modification codes for acute limb ischemia and chronic limb ischemia, the authors used the National Hospital Discharge Survey to characterize admissions for and inpatient mortality associated with acute and chronic lower-extremity ischemia. The authors report a decrease in the rate of admissions for acute and chronic limb ischemia from 42.4 per 100,000 people between 1988 and 1997 to 23.3 per 100,000 people between 1998 and 2007. During the same periods, in-hospital mortality decreased from 8.28% to 6.34% and was associated with decreasing use of surgical bypass and amputation and increasing use of catheter-based thrombolysis.

The internal validation of the International Classification of Diseases, Ninth Revision, Clinical Modification codes used to define lower-extremity thromboembolism is commendable and appears to be the first of its kind among hospitalized patients with limb-threatening arterial disease. The results, however, are not encouraging. Although the 3 codes reliably identified lower-extremity arterial thromboembolism, the specificity (72.2%) and positive predictive value (46.6%) of the codes for diagnosing acute limb ischemia were suboptimal. Moreover, the applicability of their single-institution validation strategy to a nationwide sample spanning 20 years is debatable. Given the lack of clinical specificity in diagnosis codes for arterial disease, institutional heterogeneity in coding practices seems likely. Thus, in using these codes to define the study population, the authors have defined a cohort of limb ischemia inclusive of both hospitalized progressive chronic limb ischemia and true acute limb ischemia.

In this mixed population, the authors observe a notable drop in the age-adjusted rate of inpatient limb ischemia, from 42.4 per 100,000 individuals (1988–1997) to 23.3 cases per 100,000 individuals (1998–2007). Although this may reflect a true decrease in limb ischemia, these results should be interpreted with caution. First, what the authors refer to as disease incidence is in fact the total number of hospitalizations because the National Hospital Discharge Survey does not include unique patient identifiers. Indeed, although readmission rates for patients with acute limb ischemia have not been reported, a single-center analysis of surgically treated patients with chronic limb ischemia suggested a 24% readmission rate.
at 30 days. Second, a contemporary study characterizing the epidemiology and treatment of chronic critical limb ischemia suggests that a significant number of patients receive outpatient preamputation revascularization. Because the present study includes patients with acute and chronic limb ischemia, the observed decline in hospitalization rates may reflect a shift in care from the inpatient to the outpatient arena for patients with chronic limb ischemia.

Although thought provoking, the association between mortality and increased use of endovascular revascularization techniques must also be interpreted with caution. The landmark Surgery or Thrombolysis in Lower Extremity Ischemia (STILE) and Thrombolysis or Peripheral Artery Surgery Study (TOPAS) trials randomized patients to catheter-directed thrombolytic therapy or surgical therapy and suggested equivalence between these treatment strategies in patients with acute limb ischemia. Indeed, a previous analysis of the National Inpatient Sample suggested that the need for amputation was associated with an increased risk of death and that, in those patients with an embolic origin, amputation was significantly less likely with surgical embolectomy but not thrombolytic therapy. The same study suggested that guideline-recommended heparin administration was associated with reduced mortality but that heparin administration was uniformly low throughout the study period. Given the mounting evidence that patients with chronic vascular disease are often undertreated with respect to proven guideline-based therapies for secondary cardiovascular prevention, future studies assessing mortality and procedural trends in acute vascular disease will need to concurrently evaluate medical therapies. Nevertheless, current evidence supports invasive thrombolytic strategy or surgical thrombectomy with or without required bypass as standard care for patients with acute limb ischemia.

Despite its limitations, the present study represents an important step toward a greater understanding of the changing rate of hospitalizations for limb ischemia during an era of expanding medical and interventional therapeutic options. Although medical therapies such as anticoagulants and antiplatelets may be responsible in part for any real decline, it is also likely that the declining proportion of patients with peripheral arterial disease treated with surgical bypass grafts versus endovascular therapies would result in a decrease in the rate of acute limb ischemia due to a decrease in bypass graft thrombosis. Regardless of any decline, the rate of acute limb ischemia is likely still substantial. Carefully adjudicated clinical events data from The Trial to Assess the Effects of SCH 530348 in Preventing Heart Attack and Stroke in Patients With Atherosclerosis (TRA2P-TIMI 50) indicates that, among patients with peripheral arterial disease, there remains a nearly 4% rate of hospitalization for acute limb ischemia.

How can we improve the care of the patient with acute limb ischemia? Fortunately, STEMI care provides the blueprint. The establishment of quality metrics such as heparin use, the creation of multidisciplinary systems of care designed to shorten time to therapies for the cold leg, and the initiation of patient education to enhance recognition of symptoms are vital. Finally, just as the combination of administrative claims and national registry data has provided data capture and feedback in cardiac care, a national registry for limb ischemia would complete the feedback systems needed to improve the care of limb ischemia.

**Disclosures**

Dr Curtis reports receiving research support from Johnson & Johnson and GE Healthcare. Dr Vemulapalli reports no conflicts.

**References**


KEY WORDS: Editorials arteries ischemia peripheral vascular diseases registries revascularization vascular diseases
Putting the Vascular Back Into Cardiovascular Research: ST-Segment–Elevation Myocardial Infarction as a Blueprint for Improving Care in Patients With Acute Limb Ischemia

Sreekanth Vemulapalli and Lesley H. Curtis

Circulation. 2013;128:89-91; originally published online June 5, 2013; doi: 10.1161/CIRCULATIONAHA.113.003798

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2013 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/128/2/89

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org/subscriptions/