Building a Successful Amputation Prevention Program

Our single-center experience implementing an amputation prevention algorithm and how it has led to a trend in reduced amputation rates.

BY JIHAD A. MUSTAPHA, MD; CARMEN HEANEY, BSN; MIRIAM CLARK, BSN; THERESA McGOFF, BSN; M. ANDREA PETERSON, MSN; SARA FINTON, BSN; CAROLYN FOX, BSN; AND KRISTY CUSACK, BSN

Patients suffering from critical limb ischemia (CLI) with nonhealing wounds are among the most complicated to treat. Limb loss is a potentially devastating event in a person's life, often resulting in profound physical, psychological, and vocational consequences.[1] Patients with CLI frequently exhibit multiple comorbidities requiring a specialized multidisciplinary team for optimal medical management. Improved awareness of the need for limb preservation has given rise to a concept, similar to that of wound care centers, that is increasingly referred to as a *limb salvage* or *amputation prevention program*. In 2009, Metro Health Hospital instituted an evidence-based amputation prevention approach that has evolved into StAMP (Stamping Out Amputation One Limb at a Time), an amputation prevention program. The implementation of a team approach led to a systematic process for patient screening, evaluation, treatment, and follow-up, with the collective goal of achieving the best patient outcomes.

The StAMP approach has resulted in enhanced recognition of peripheral vascular disease and CLI among patients and health care providers, including podiatrists and primary care physicians. Enhanced awareness has led to an increased number of patients seeking care for peripheral vascular disease (PVD) at Metro Health Hospital and has caused a marked increase in the number of endovascular interventions performed (Figure 1). Of interest, while the number of patients treated by an endovascular-first approach has increased, the rate of major (above and below the knee) and minor (below the ankle) amputations has significantly decreased (Figure 2). A paradigm shift occurred in a short period of time; patients with CLI who previously would have been referred for amputation immediately were instead referred for endovascular limb salvage procedures. The rate of major amputation has dropped significantly, from 0.046 per hospital encounter to 0.009—evidence that an organized, comprehensive team approach to CLI treatment can provide promising results.

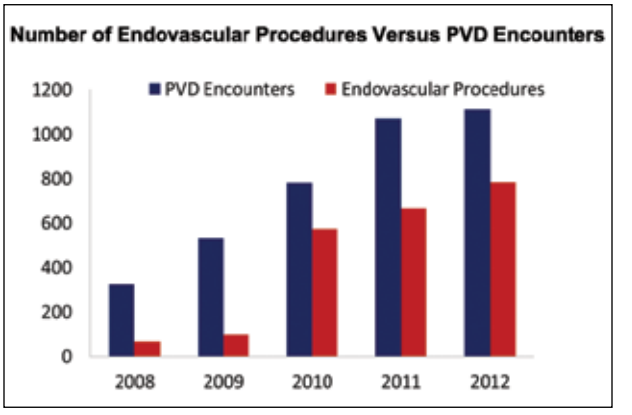

Figure 1. The number of endovascular procedures versus PVD encounters from 2008 to 2012.

CASE STUDY

This single-patient case study exemplifies the value of an amputation prevention program. A 74-year-old man

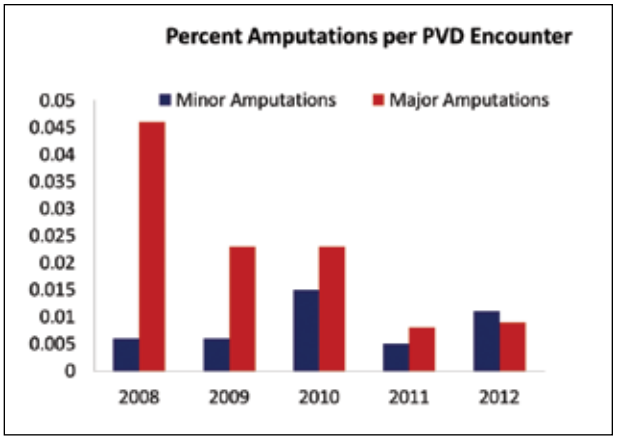

Figure 2. The percentage of amputations per peripheral vascular disease encounter from 2008 to 2012.

presented for evaluation of a nonhealing stump wound. Six years earlier, he was seen at an outside institution with a 1-week history of left foot redness and pain. At that time, the patient was noted to have decreased range of motion of the left foot, with erythema extending to the ankle. The patient denied any previous history of rest pain, intermittent claudication, or trauma, and his medical and surgical histories were nonsignificant. He did not have a primary care physician and had not been seen by a physician in the recent past.

Diagnostic examination revealed left foot cellulitis. He underwent irrigation and debridement in an attempt to decompress the inflamed region. The patient was also noted to have hypertension and hyperglycemia, and appropriate medical management was initiated. The patient's clinical course continued to deteriorate with the development of persistent fevers and further progression of left foot edema. He was diagnosed with possible osteomyelitis of his second, third, and fourth metatarsals by both bone scan and magnetic resonance imaging. Extensive necrosis developed. After infectious disease and vascular surgery consultations, the patient was taken for a guillotine amputation. On the second postoperative day, the patient returned to the operating room for debridement and wound closure.

Due to his deconditioning and multiple complex diagnoses, the patient was discharged to a long-term assisted-care facility. Two weeks later, the transmetatarsal amputation site became necrotic, and the patient underwent below-the-knee amputation. The patient did not undergo angiography at any time before his amputations.

Upon presentation to Metro Health Hospital, the patient's medical history was significant for type II diabetes, hypertension, congestive heart failure, dys-

Figure 3. Presentation of a patient to the endovascular specialist. Note the diffuse erythema of the anterior aspect of the right lower extremity.

Figure 4. Dorsal view of the left stump ulcer on presentation to the endovascular specialist.

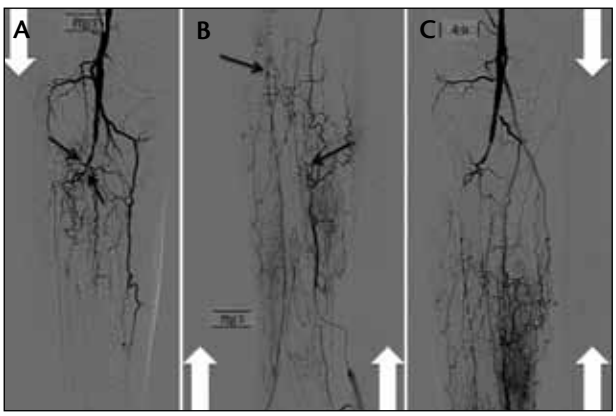

Figure 5. Baseline right lower extremity antegrade (white arrow) selective angiogram showing severe multiple tibial CTOs (black arrows) (A). Baseline right lower extremity retrograde dual-tibial access (white arrows) and retrograde selective angiogram showing multiple tibial CTOs (black arrows) (B). Simultaneous antegrade and retrograde (white arrows) selective angiograms showing severe, complex CTOs (C).

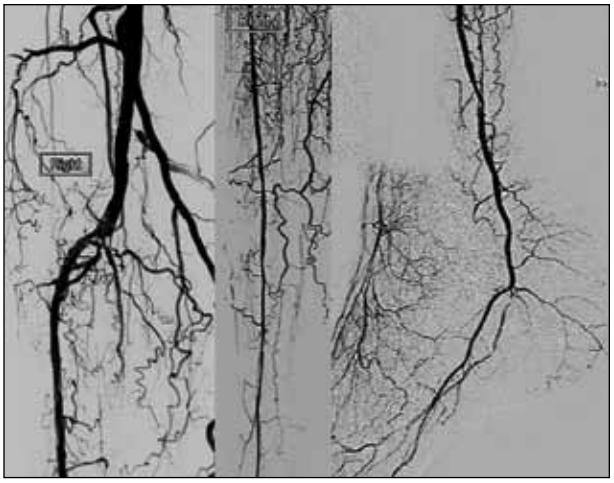

Figure 6. Imaging after successful endovascular revascularization, this angiogram demonstrates 0% residual stenosis.

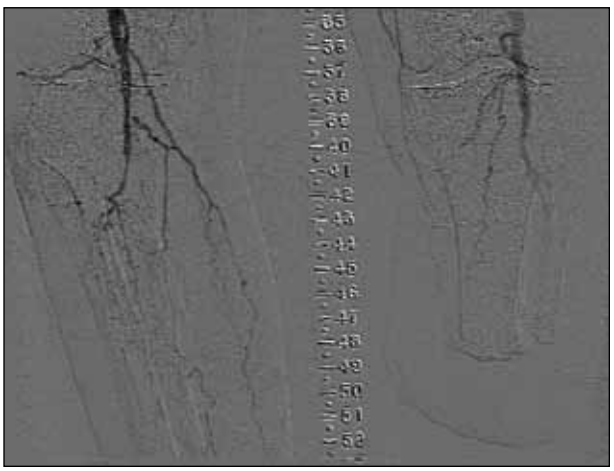

Figure 7. Baseline nonselective angiography of the left extremity popliteal artery with tibial and stump run-off demonstrated 70% occlusion of the popliteal and 95% occlusion of the anterior tibial artery.

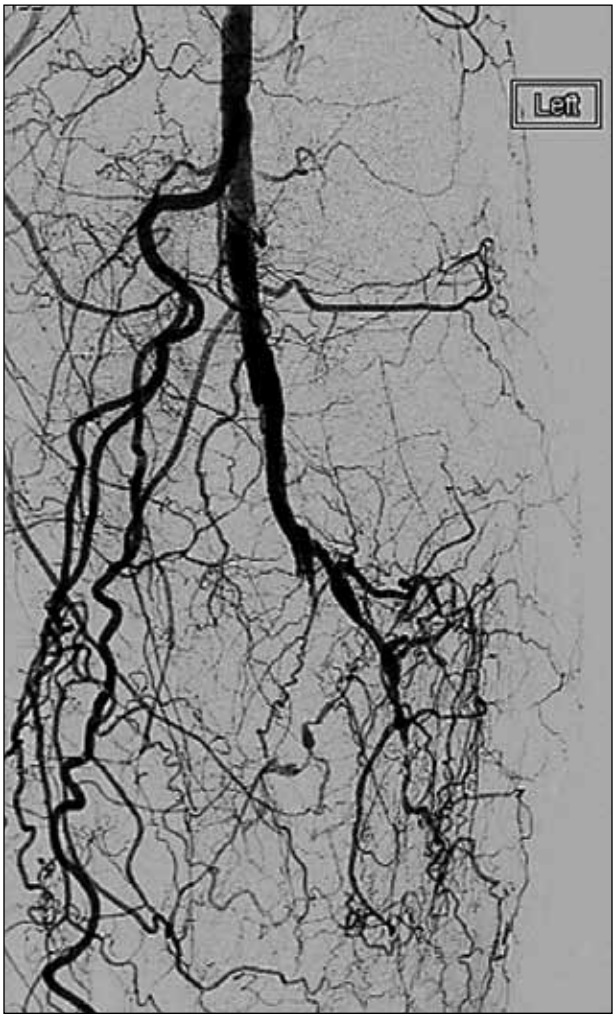

Figure 8. Postprocedural angiography demonstrating a reduction of the popliteal lesion stenosis to 0% and the anterior tibial lesion to 10% stenosis.

lipidemia, acute renal insufficiency, and peripheral vascular disease. The patient initially presented to the wound clinic for evaluation of a small, nonhealing ulcer on his left stump. The patient reported intermittent wounds over the course of 6 years due to rubbing of his prosthesis. In addition to the ulcer on the patient's left stump, he reported a 1-week history of rest pain in his right toes and diffuse erythema of the anterior aspect of his right lower extremity. The erythema was deemed unlikely to be ischemic in nature. An x-ray was performed, revealing gas in the soft tissues, which is suggestive of cellulitis or ulceration. No radiographic evidence of osteomyelitis was noted. The patient began undergoing serial debridement therapy with ongoing wound assessment.

Instituting the multidisciplinary team approach, the wound clinic referred the patient to an endovascular specialist. The patient reported that his symptoms on the right were very similar to the symptoms experienced on the left 6 years ago, before amputation (Figures 3 and 4).

Due to his Rutherford 5 classification, right ankle-brachial index of 0.65, and toe-brachial index of 0.52, bilateral selective angiography was performed. The angiogram showed that the proximal third of the tibial vessels on the amputated leg had a very similar appearance to the vessels on the right lower extremity. The patient was diagnosed with CLI with chronic total occlusion (CTO) of the right anterior tibial artery at the takeoff, at the tibial peroneal trunk proximally, and at the peroneal artery proximally. Upon reconstitution of

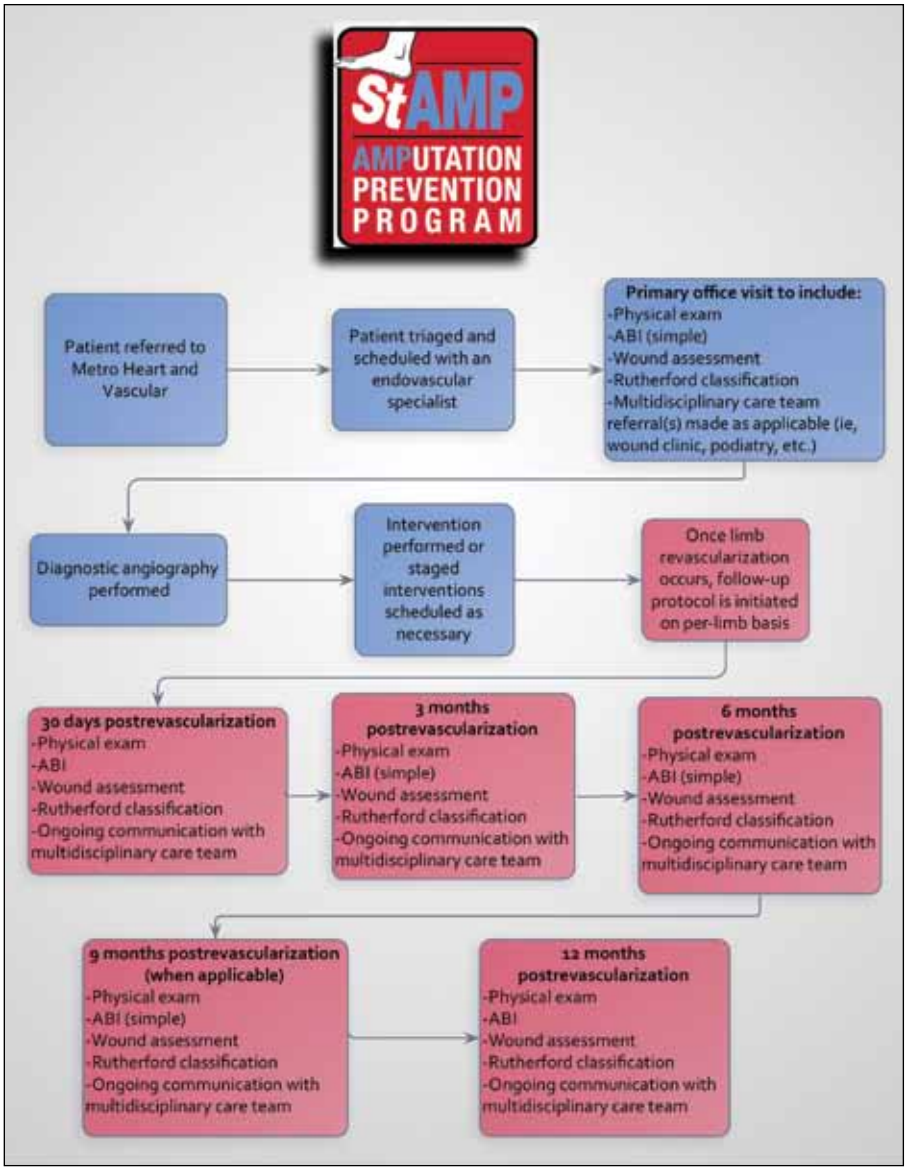

Figure 9. StAMP Amputation Prevention Program patient care algorithm.

the posterior tibial artery distally and midperoneal and anterior tibial proximally, we observed severe tandem lesions that were 90% to 99% occluded (Figure 5).

The patient underwent a peripheral vascular intervention of the right anterior tibial and popliteal arteries via a minimally invasive, retrograde, dual-tibiopedal arterial revascularization technique, using ultrasound-guided right anterior tibial and posterior tibial access approaches.[2] Antegrade Diamondback atherectomy (Cardiovascular Systems, Inc., Minneapolis, MN) and balloon angioplasty of the right popliteal and anterior tibial arteries were performed followed by stenting of the popliteal artery using a 6- X 60-mm Flex stent (Cordis Corporation, Bridgewater, NJ). Both lesions were reduced to 0% stenosis (Figure 6). This procedure allowed limb salvage of the patient's right leg. This leads to the question: Would selective angiography followed with revascularization of his left lower extremity have prevented his major amputation?

Approximately 1 month after the revascularization procedure, the patient returned for a staged intervention of the left lower extremity to treat the nonhealing wound located on the stump. Selective angiography demonstrated a 70% occlusion of the popliteal artery and a 95% occlusion of the anterior tibial artery (Figure 7). The lesions were treated with the VascuTrak scoring balloon (Bard Peripheral Vascular, Tempe, AZ) followed by traditional balloon angioplasty, reducing the popliteal lesion stenosis to 0% and the anterior tibial lesion to 10% stenosis (Figure 8). The procedure was performed without complication, and he was discharged home the next day. At the time of this writing, 1 month postprocedure, the patient has demonstrated wound healing, resolution of rest pain, and an ankle-brachial index on the right limb of 0.99.

IMPLEMENTING THE STAMP AMPUTATION PREVENTION PROGRAM

The StAMP Amputation Prevention Program is a team that was compiled and led by a physician who championed this approach. Essential members of the team are each specially trained to screen, triage, and treat patients with CLI. Team members include an endovascular specialist, noninvasive imaging specialist, midlevel provider, registered nurse, vascular technicians, medical assistant, schedulers, cardiovascular laboratory interventional

Due to rapidly evolving CLI therapies and technology, ongoing education is imperative for all members of the multidisciplinary team to ensure proper care of patients with CLI.

team, and clinical research staff. The team also includes a dedicated Peripheral Vascular Coordinator (registered nurse position) whose responsibilities include policy and procedure development, the organization of educational and screening events, facilitation of out-of-area referrals, and coordination of communication between members of the multidisciplinary team.

The StAMP program relies heavily on multidisciplinary specialists from the areas of podiatry, wound clinic, vascular surgery, infectious disease, nutrition, rehabilitation, and primary care. Primary care providers are the coordinators of care in treating and managing the CLI patients' comorbidities. Each specialty is considered and consulted on a case-by-case basis, depending on the individual patient's needs. Communication among the care team is imperative during the treatment course and follow-up period.

The StAMP program has developed an algorithm for the flow of care of the CLI patient (Figure 9). Once a patient with advanced peripheral artery disease (PAD) or CLI is identified, the StAMP algorithm is initiated. A standardized referral system is used to ensure that the necessary information is provided for the appropriate triage of new patients. This allows the proper diagnostic tests to be performed to establish a baseline profile of the patient's peripheral disease. The continued algorithm then provides consistency in treatment and postrevascularization follow-up. Participation in clinical research and patient outcome evaluation contributes to timely process improvements, as well as the development of new treatment modalities.

Due to rapidly evolving CLI therapies and technology, ongoing education is imperative for all members of the multidisciplinary team to ensure proper care of patients with CLI. Internally, education is provided during vascular case conferences ("lunch and learns") and meetings among the different subspecialties. External education opportunities can be provided by vendor representatives and attendance at national and regional conferences.

Patient education and community screenings are key factors in the success of the program. PAD screening is performed annually on all patients in the practice. The screening begins with a standardized screening questionnaire, which is available for use in all primary care offices within our health care system. In addition to the annual office screening, community-based free PAD screening events are hosted two to three times per year.

Institutional administrative support is also essential to the success of an amputation prevention program. The financial benefit of amputation avoidance should be considered, although it is difficult to place monetary cost on the psychosocial impact of amputation to a patient. As stated by Albert Einstein, however, "Not everything that counts can be counted, and not everything that can be counted counts." ■

Jihad A. Mustapha, MD, is with the Department of Internal Medicine, Cardiovascular Medicine, Metro Health Hospital, and is Assistant Clinical Professor of Medicine, Michigan State University COM. He has disclosed that he is a trainer and consultant for CSI, Bard, Cordis, Cook, Terumo, and Covidien, and a research investigator for Cook and Bard. Dr. Mustapha may be reached at jihad.mustapha@metrogr.org.

Carmen Heaney, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

Miriam Clark, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

Theresa McGoff, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

M. Andrea Peterson, MSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

Sara Finton, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

Carolyn Fox, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

Kristy Cusack, BSN, is with the Department of Clinical Research, Metro Health Hospital in Wyoming, Michigan. She has disclosed that she has no financial interests related to this article.

1. Dillingham TR, Pezzin LE, MacKenzie EJ. Limb amputation and limb deficiency: epidemiology and recent trends in the United States. South Med J. 2002;95:875-883.

2. Mustapha JA, Saab F, Diaz L, et al. Utility and feasibility of ultrasound guided access in patients with critical limb ischemia. Catheter Cardiovasc Interv. In press.