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Outcomes of Chopart Amputation in a Tertiary Referral Diabetic Foot Clinic: Data From a Consecutive Series of 83 Hospitalized Patients

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ABSTRACT

The purpose of the present retrospective study was to evaluate the outcomes (ie, ulcer recurrence, major amputation, death) in diabetic patients undergoing Chopart amputation because of deep infection or gangrene extending to the midfoot. From 2009 to 2011, 83 patients, aged 71.4 ± 9.3 years, underwent a midtarsal amputation and were followed up until December 31, 2012 (mean follow-up 2.8 ± 0.8 years). Of the 83 patients, 26 were female, 61 required insulin, 47 had renal insufficiency, 19 underwent hemodialysis, 65 had hypertension, 34 had a history of cardiac disease, and 4 had a history of stroke. Chopart amputation was performed in 38 patients (45.8%) with gangrene, 31 (37.4%) with abscess, and 14 (16.9%) with osteomyelitis. Urgent surgery was performed in 56 patients (67.5%). Effective revascularization was performed in 64 patients (77.1%) patients. Of the 83 patients, 47 had healed at a mean period of 164.7 (range 11 to 698) days. Ulcer recurrence developed in 15 patients (31.9%). A major amputation was necessary in 23 patients (27.7%), with an annual incidence of 13.0%. None of the included variables on logistic regression analysis was significantly associated with proximal amputation. Of the 83 patients, 38 (45.8%) died, with an annual incidence of 25.8%. On logistic regression analysis, age (odds ratio [OR] 1.11, 95% confidence interval [CI] 1.01 to 1.16), history of stroke (OR 9.94, 95% CI 3.16 to 31.24), and urgent surgery (OR 2.60, 95% CI 1.14 to 5.93) were associated with mortality. Chopart amputation represents the last chance to avoid major amputation for diabetic patients with serious foot complications. Our success rate was great enough to consider Chopart amputation a viable option for limb salvage in this high-risk population.

Although many reports have been published concerning surgical treatment or specific orthoses to prevent deformities, studies that have analyzed the risk factors, determinants, and outcomes of Chopart amputation are lacking (1–5). Some debate exists regarding the efficacy of the Chopart amputation, because of the high incidence of complications and the occasional need for a more proximal amputation (above the ankle) (6–9). We perform the Chopart amputation in patients with tissue destruction extending to the entire midfoot secondary to gangrene or infection. Such patients would otherwise have required a major amputation. We consider the Chopart amputation level an extreme limb salvage attempt, even if it does have the potential for a large number of complications.

The aim of the present retrospective study was to examine the healing times and frequency of limb salvage, operative complications, major amputation, and mortality in a consecutive series of patients who had undergone Chopart amputation in our diabetic foot center from January 1, 2009 to December 31, 2011.

Patients and Methods

All diabetic patients referred to our diabetic foot center for foot lesions or pain at rest were evaluated on hospital admission to identify the presence of sensory-

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motor neuropathy, chronic critical limb ischemia (CLI), infection, metabolic control, and comorbidities. The ulcer grade according to the Texas wound system classification was recorded (10). Each lesion was photographed on hospital admission and during the follow-up period. Diabetic neuropathy was detected by a vibration perception threshold >25 V using a biothesiometer (Neurothesiometer SLS, Nottingham, UK) and absence of sensitivity in >5 of 9 foot sites using Semmes-Weinstein 10-g filament examination.

According to the Trans-Atlantic Inter-Society Consensus Document on Management of Peripheral Arterial Disease II parameters, CLI was diagnosed if the transcutaneous oxygen tension at the dorsum of the foot was <30 mm Hg and the ankle pressure was <70 mm Hg (11). (Ankle pressures were not determined when ankle pulses were absent or not compressible owing to medial arterial calcifications.)

All patients with CLI underwent an angiographic study. If an obstruction of >50% of the vessel diameter was present, percutaneous transluminal angioplasty was performed in the same session as the first-choice revascularization procedure. In patients in whom percutaneous transluminal angioplasty was unsuccessful, a peripheral bypass graft was considered.

Revascularization was performed before the definitive surgical procedure in patients with osteomyelitis or dry gangrene and before final wound closure in patients with abscess or wet gangrene who had previously undergone initial surgical debridement.

Surgical Interventions

All patients with abscess or wet gangrene were eligible for surgical "emergent" treatment, and all patients with dry gangrene or osteomyelitis were eligible for surgical "curative" treatment, according to the classification of diabetic foot surgery proposed by Armstrong and Frykberg (12).

If a deep space infection was present, the patient was taken immediately to the operating room for urgent surgical debridement. After evacuation of purulent drainage, the lateral, central, and medial compartments were explored. Before using antiseptics, a biopsy sample was obtained for microbial culture. Specimens for culture were properly collected after wound debridement to avoid contamination and optimize identification of the pathogens. The wound was left open at this point to allow for further drainage and wound management (13).

Intravenous broad-spectrum antibiotic therapy with ≥2 antibiotics, a piperacillin-tazobactam combination plus metronidazole or fluoroquinolone, was immediately administered (14). The antibiotic therapy was adjusted as soon as the results of the susceptibility tests were available. In all patients, wound closure was performed when the fever had subsided, the leukocyte count was normal ($<10^3$ mm^3), and the signs of inflammation in the foot had resolved.

Midfoot osteomyelitis was diagnosed when the probe-to-bone maneuver was positive or plain radiography of the involved foot showed the presence of lytic lesions and/or a periosteal reaction. According to our clinical practice, bone biopsy was usually avoided to prevent the spread of contamination from surgery. Magnetic resonance imaging was used to confirm our suspicions for the presence of osteomyelitis in the area of amputation and to exclude involvement of the talus and calcaneus (15).

For nonemergency wound infections, debridement of the ulcer was performed at the initial visit, and a biopsy sample for microbial culture was obtained. All patients were given parenteral antibiotic therapy, which could be modified during the subsequent visits according to the culture results. Patients were then examined in the outpatient clinic once a week. After 4 weeks of antibiotic therapy and local dressing changes, if the probe-to-bone test and plain radiography of the involved foot were both still positive, the patients were admitted to our center for surgical elective therapy. The portion of infected bone removed during surgery was sent for histologic examination. In these patients, wound closure was performed in the same session or surgical procedure.

Patients with dry gangrene have a clinical course similar to that of patients with osteomyelitis. The level of amputation is only partially dependent on residual healthy skin and primarily depends on the presence of osteomyelitis in the cuboid or navicular bones (16).

The Chopart amputation was performed according to the usual technique, including percutaneous lengthening or tenotomy of the Achilles tendon, but with no tendon transposition to avoid further infection in patients who were already severely infected (17). Surgical intervention was performed on the same day of hospital admission in patients with an urgent indication and the day after in patients with an elective indication. In all patients, a femoral and sciatic nerve block was used by our anesthesiologists, aided by electrical bipolar signal.

Recorded Demographic and Clinical Variables

For each patient, all of the following variables were recorded: gender and age; type, duration, and treatment of diabetes; history of cardiac disease, stroke, diabetic retinopathy, arterial hypertension; previous minor or major amputation; length of hospital stay; sensory-motor neuropathy; treatment of CLI if present; minor amputation performed elsewhere; emergency operation; and the presence of lesions in the contralateral foot. The clinical laboratory variables considered in the present study included the blood glucose level on admission and discharge, glycated hemoglobin level, serum creatinine, serum albumin, hematocrit, C-reactive protein, and leukocyte count.

Outcome Measures

The primary endpoint of the study was limb salvage after Chopart amputation (18). The foot was considered healed when complete re-epithelialization of the surgical wound had occurred. The healing times were calculated for each patient, considering the interval between the day of admission and the day of complete re-epithelialization.

Ulcer recurrence was considered present at the appearance of a new lesion at any part of the foot. An above-the-ankle amputation was proposed and performed in patients in whom the lesion extended above the Chopart joint. An above-the-ankle amputation was considered a major amputation.

Follow-up

After hospital discharge, all patients were examined weekly until the ulcer had healed and monthly thereafter in absence of recurrence. During the wound healing period, all patients were provided a postoperative walker (Optima® Molliter, Civitanova Marche, Italy) and, once healed, with a customized orthotic. The walkers are composed of a specifically designed rigid, boat-shaped, and fully rocker bottom sole, with the aim of blocking ankle motion. The customized insoles were shaped by cast using Alcapy, a material derived from Professional Protective Technology (Deer Park, NY). The insoles were modified or changed every 6 months, and the shoes were modified according to wear. The vital status of all patients included in the study was determined at the end of the follow-up period. The date and cause of death were also recorded.

Statistical Analysis

Statistical analysis was performed using STATA for Windows (release 12; StataCorp, College Station, TX). Data are presented as the mean ± standard deviation or percentages. Comparisons between group characteristics were performed using a chi-square test (frequency data) or *t* Student test (continuous data). The time to an event was evaluated using the Kaplan-Meier method.

Univariate logistic regression analyses were performed for all potential predictor variables with the outcome of interest, with the data presented as odds ratios (ORs) and respective 95% confidence intervals (CIs). The same analysis was performed using multivariate logistic regression and stepwise selection of independent variables to enlighten the independent factors associated with survival. A p value of $< .05$ was considered statistically significant.

Results

Patient Population

From January 2009 to December 2011, 83 diabetic patients were admitted to our diabetic foot unit and underwent a midtarsal (Chopart) amputation. All patients were followed up until December 31, 2012. The mean follow-up period was 2.8 ± 0.7 (range 1.1 to 4.0) years.

The demographic and clinical characteristics of the study population are listed in Table 1. Of the 83 patients, 3 were admitted to our emergency department, and 80 had been referred by other hospitals. Of the 80 patients, 34 (42.5%) had been referred after failure of a minor foot amputation. Of the 83 patients, 63 underwent emergency surgery (75.9%), 31 because of abscess and 32 because of wet gangrene, and 20 underwent elective surgery, 14 because of osteomyelitis and 6 because of dry gangrene.

Of the patients with CLI, successful revascularization was performed in 8 (12.5%) with bypass graft and in 56 (87.5%) with peripheral transluminal angioplasty. The mean transcutaneous oxygen tension before revascularization was 13.9 ± 10.1 mm Hg and after revascularization was 48.9 ± 14.4 mm Hg ($p < .001$).

Complications occurred in 10 patients: 6 cardiac, 2 pulmonary, 1 acute renal insufficiency (temporary dialysis), and 1 encephalitis. Blood transfusions were administered to 41 patients (49.4%).

Salvaged Limbs

Of the 83 patients, 47 (56.6%) had healed completely after a mean interval of 164.7 (range 11 to 698) days. Of the 47 patients, 16 healed