Mortality and Morbidity After Transmetatarsal Amputation: Retrospective Review of 101 Cases

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Medical records were reviewed for 90 patients (101 amputations) (mean age 64.3 years, range 39 to 86 years) who underwent transmetatarsal amputation (TMA). The mean follow-up period, excluding those patients who either died or went on to a more proximal amputation less than 6 months after TMA, was 2.1 years. Patients were examined for any postoperative complications associated with TMA. Complications were defined as hospital mortality occurring less than 30 days postoperatively; stump infarction with or without more proximal amputation; postoperative infection; chronic stump ulceration; stump deformity in any of 3 cardinal planes; wound dehiscence; equinus and calcaneus gait. An uncomplicated outcome was defined as the absence of all these complications and an ability to walk on the residuum with a diabetic shoe and filler after a minimum follow-up of 6 months. The χ^2 tests of association were used to determine whether diabetes, a palpable pedal pulse, coronary artery disease, end-stage renal disease, cerebral vascular accident, or hypertension were predictive of or associated with healing. A documented palpable pedal pulse was a predictor of healing (P = .0567) and of not requiring more proximal amputation (P = .03). End-stage renal disease predicted nonhealing (P = .04). A healed stump was achieved in 58 cases (57.4%). Postsurgical complications developed in 88 cases (87.1%). Two patients died within 30 days postoperatively. These data suggest that TMA is associated with high complication rates in a diabetic and vasculopathic population. (The Journal of Foot & Ankle Surgery 45(2):91–97, 2006)

Key words: amputation, transmetatarsal, diabetic foot, gangrene, end-stage renal disease

Transmetatarsal amputation (TMA) is an effective surgical approach to treating forefoot infection, gangrene, and chronic ulceration in diabetic and dysvascular patients (1–10). The goal of TMA is twofold: to adequately control forefoot infection or ischemia by removing all necrotic, ischemic, or infected tissue to a level that allows healing; and to maximize limb function by salvaging the midfoot and rearfoot, thus leaving a plantigrade platform on which the patient can adequately bear weight and walk. However, complications after this limb salvage procedure are not uncommon. Sage et al (11) reported complications in 42% of patients who had midfoot amputation of neuropathic and dysvascular feet. In a study by Mueller et al (12), subsequent skin breakdown developed in 27% of patients who had TMA, and 28% of patients who had TMA required higher amputation. Healing rates after TMA have ranged from 39% to 93.3% (2, 4, 6–8, 10, 12–15).

Despite its potential complications, TMA is considered preferable to below-the-knee amputation (BKA) or above-the-knee amputation (AKA), because TMA allows a weight-bearing residuum to remain and has a lower mortality rate (16). In a study of hospital mortality occurring within 30 days after BKA and AKA, Feinglass et al (17) recorded a 6.3% mortality rate among 1909 patients after BKA and a 13.3% mortality rate among 2152 patients after AKA. Other studies (8, 9, 12) reported substantially lower

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Presented at the 63rd Annual Scientific Conference of the American College of Foot and Ankle Surgeons, March 9–13, 2005, New Orleans, LA.

1067-2516/06/4502-0006$32.00/0
doi:10.1053/j.jfas.2005.12.011

30-day postoperative mortality after TMA, and a series described by Geroulakos and May (4) had a postoperative mortality rate of 3%.

Although amputation at a higher level often results in more predictable healing (7), BKA or AKA is not done without substantial cost. Waters et al (18) noted that the energy cost of walking with a residual limb is inversely proportional to length of the remaining limb and number of functional joints preserved.

The purpose of the current study is to report our results after TMA in a large diabetic and dysvascular patient population. Associated co-morbidities were examined for statistical significance in either complication or healing rate.

Materials and Methods

Medical charts and electronic databases were retrospectively reviewed for 108 patients seen consecutively for TMA. Surgery was performed by the senior authors at Kaiser Permanente Oakland, Richmond, and Walnut Creek, between April 1993 and January 2004. Outcome assessments were performed by the senior authors at the last documented office visit.

Indications for surgery were chronic forefoot ulceration (Fig 1*A*), forefoot infection, forefoot gangrene (Fig 1*B*), or a combination of these (Table 1). Operative technique and postoperative management were similarly applied for each patient by the attending podiatric surgeons at each institution. Percutaneous tendo-Achilles lengthening (TAL) procedures were routinely performed in all patients who were predicted to be ambulatory after TMA. In cases of extensive infection, the skin incision was not primarily closed at the initial surgery, and only closed when all signs of active infection were eliminated.

Only patients who had a minimum 6 months of postoperative follow-up or had died by follow-up were included in this study. Ninety patients (101 consecutive amputations) satisfied the inclusion criteria. The Kaiser Permanente Northern California Region Institutional Review Board approved the study.

Data collection included age, gender, diabetic versus nondiabetic status, history of coronary artery disease (CAD), cerebral vascular accident (CVA), hypertension, or end-stage renal disease (ESRD). These co-morbid conditions were compared with final outcome (12, 15, 19). Vascular status for all patients was assessed before surgery. Presence or absence of palpable pedal pulses was routinely noted. Presence of an audible Doppler signal, ankle brachial index (ABI) score, angiography results, or toe pressure was recorded for patients who did not have a palpable pulse.

Data were collected retrospectively to assess presence or absence of complications occurring after TMA. Complications were defined alternatively as mortality occurring less than 30 days postoperatively, stump infarction with or without more proximal amputation, postoperative infection, equinus or calcaneus gait, stump deformity in any of the three cardinal planes, wound dehiscence, and chronic stump ulceration. Chronic ulceration was defined as dehiscence lasting more than 90 days or a healed stump that reulcerated. Uncomplicated outcome was defined as absence of all these complications and an ability to walk on the stump with a diabetic shoe and filler after a minimum follow-up of 6 months. Data were compared using χ^2 and Fisher exact tests.

Operative Technique

The TMA procedure was done with the patient supine. The ulcerated or gangrenous forefoot was covered with an elastic bandage or a surgical glove before any incisions were made. Percutaneous TAL (20, 21) was done first and, in some cases, was staged if infection was extensive.

The second part of the operation was amputation of the forefoot. The viable soft-tissue envelope determined the incisional approach. A fishmouth incision proximal to the compromised forefoot tissue and bone was used most commonly. The apexes of the incision were placed medially at about the midshaft level of the first metatarsal and laterally at the midshaft level of the fifth metatarsal (Fig 2*A*). Alternatively, a more transverse dorsal incision was made with a longer plantar flap. The dorsal incision is made first and carried to bone. Bleeding vessels were tied or cauterized. The metatarsal shafts were identified and exposed with a periosteal elevator. The shafts were resected using an oscillating or sagittal saw so that the distal ends of the shortened metatarsals defined a smooth arc. The plantar incision was made next so that a plantar flap was created. The forefoot was removed, and all remaining tendon stumps were excised under tension (Fig 2*B, C*). After irrigation with pulsed lavage, the wound was closed. Strategically placed nonabsorbable deep sutures were used to reapproximate the flaps. The skin was then closed using nonabsorbable suture. The flaps were approximated without any tension (Fig 2*D*).

Patients were placed into a posterior splint and were admitted to the hospital for culture-specific intravenous antibiotics and observation. The splint was removed after 2 days, at which time a new dressing was applied. Each subsequent day, the flaps were assessed for signs of infarction or reinfection. When discharged from the hospital, patients were placed in a total-contact cast, which was then removed on a weekly basis. The stump was rechecked on an outpatient basis. Use of an assistive device (eg, walker, crutches, wheelchair) was advised for strict nonweightbearing. Sutures were removed at about 21 days postoperatively. Patients were kept in the contact cast until diabetic shoes with a TMA filler were fabricated and fitted. If any wound