ELSEVIER

Pedicled Flaps in Association With Distal Bypass for Lower-Limb Salvage

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Background: After distal bypass for limb salvage, persistence of large ischemic ulcers with exposure of tendons, joints, and bone and secondary graft exposure can lead to amputation, even though the bypass remains patent. Coverage of such defects using free flaps is too lengthy and complex for use in elderly patients. Although quick and simple, pedicled flaps are often considered to be contraindicated in patients with occlusive artery disease. The purpose of this study was to evaluate the outcome of pedicled flaps harvested after evaluation of revascularized territories on angiograms for coverage of tissue defects.

Methods: From 1994 to 2000, a total of 23 pedicled flap procedures were performed in 22 patients with a mean age of 75 years (range, 54–91 years). The distal anastomosis of the bypass was located on a tibial or pedal artery in 19 cases and on the popliteal artery in 4. The indication for flap placement was chronic ulcer in 7 cases, secondary graft exposure in 15, and open fracture with acute ischemia in 1. To be considered as usable, the flap had to be vascularized by a pedicle fed by the bypassed artery and have a rotational axis sufficient to cover the defect. Muscle flaps were used in 11 cases, fasciocutaneous flaps in 10, and fascial flaps in 2.

Results: The flap procedures in this study led to primary healing in 17 cases, secondary healing in 4 cases, and failure due to necrosis in 2. Follow-up examination was carried out with Doppler ultrasonography at 1, 6, and 12 months and every 6 months thereafter. The mean follow-up period was 23 months (range, 3–5 years). Statistical analysis demonstrated bypass patency, limb salvage, and survival rates in agreement with those previously reported in the literature.

Conclusions: Our results suggest that pedicle flaps are feasible after distal bypass in patients with lower-extremity occlusive artery disease. This technique expands the indication for limb salvage with low morbidity.

INTRODUCTION

Distal bypass revascularization for limb salvage in patients presenting with ischemic ulcers or gangrene usually allows for healing, either spontaneously or after skin grafting. However, because they cannot heal, ulcers exposing major structures such as bone, joints, and tendons cause pain, lead to infectious complications, and prevent resumption of walking. Without further treatment, patients with persistent ulcers require amputation, despite successful revascularization.[1,2] Secondary exposure of the distal bypass anastomosis due to skin necrosis on the leg or foot occurs in 1% to 10% of cases,[3–6] and it can also lead to amputation or death due to bypass blowout.[7,8] In extreme cases, flap surgery is necessary to treat the defect. Free-flap surgery has been used in association with distal bypass to achieve coverage of large defects[1,2,9,10] but rarely to cover exposed anastomoses.[11,12] Widely used to cover anastomoses at the femoral bifurcation, pedicled flap procedures have rarely been performed on the leg.[1–15] Although specific techniques have been successful,[16,17] distal pedicled flap surgery is

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generally considered as contraindicated in patients with occlusive artery disease.[12,16] Most plastic surgeons justify this opinion without documented evidence and based solely on results in patients who did not undergo revascularization. Nevertheless, it seems reasonable to think that the results of pedicled flap surgery would be better in patients in whom near-normal blood flow in the lower leg has been restored by distal bypass. The purpose of this study was to evaluate the outcome of simple pedicled flap surgery in association with distal bypass.

PATIENTS AND METHODS

Between 1994 and 2000, a total of 23 pedicled flap procedures were performed for coverage of tissue defects on the legs and ankles of 22 patients. Mean age of the patients was 75 years (range, 54–91 years). The cause of the tissue defect (Table I) was exposure of the arterial graft in 15 cases, an ulcer of arterial origin with or without venous insufficiency in 8, and open fracture of the leg with acute ischemia in 1. The mean duration of hospitalization was 42 days (range, 12–95 days).

In patients presenting with graft exposure, the mean interval between distal bypass and flap coverage was 33 days (range, 4–135 days). In 11 of these 15 cases, graft exposure occurred >3 weeks after bypass. As soon as graft exposure was diagnosed, a bacteriological swab was collected and a dressing was applied in association with betadine–saline washing to limit infection and avoid drying of the vein in case of venous bypass. Flap coverage was performed within 5 days after diagnosis.

A multidisciplinary approach was used, with concerted analysis of all cases by vascular and plastic surgeons. Distal revascularization had been performed in all cases, including venous bypass in 21 cases, prosthetic bypass in 7, and isolated dilatation of the peroneal artery in 1. Bypass patency was checked by Doppler ultrasonography before flap coverage. The choice of flap type was based on careful arteriographic study of the following criteria: visibility of the pedicle on arteriograms for muscle flaps and visibility of the proximal part of the pedicle and Doppler audibility for fasciocutaneous flaps. All flaps were harvested from a territory revascularized by the bypass or an artery without significant proximal stenosis. In half of the cases, preoperative arteriography provided sufficient evidence to decide flap type. In the other half, it was necessary to perform completion arteriography to study distal arterial network after bypass.

Before flap coverage, bacteriological studies demonstrated infection of the defect in 19 cases. Specific antibiotic therapy, according to the organism identified, was administered for 10 days in patients with graft exposures and 5 days for patients with isolated ulcers. Patients not presenting with infection underwent prophylactic antibiotic therapy using a second-generation cephalosporin for 48 hours. During flap coverage, extensive debridement was performed to eliminate all foci of infection. The flap type was muscle graft in 11 cases, fasciocutaneous graft in 10, and fascial graft in 2 (Table I).

As is widely observed in plastic surgery, the flaps most commonly used for cutaneous coverage were the soleus and gastrocnemius muscle flaps. Short and long toe extensor muscle flaps were less frequently used, but they proved to be highly versatile for coverage of exposed distal grafts (e.g., on the external and anterior side of the lower fourth of the leg) (Figs. 1 and 2). Harvesting of short and long toe extensor muscle flaps was performed after complete debridement of necrotized tissue. An extended incision was made along the long axis of the muscle, starting at the edge of the defect. After exposure on the superficial side, the primary muscle fiber bundle was carefully raised to allow identification of the pedicles of the anterior tibial artery (type IV in the classification by Mathes and Nahai).[18] The distal tendon of the common extensor muscle and, if necessary, of the extensor itself was divided. The muscle was moved carefully. The perymisium must be respected in order to preserve blood supply for additional skin graft. The flap was then positioned using the retractor thread and attached by a transcutaneous suture in a remote location. Finally, the exposed muscle was covered using a thin skin graft. In most cases, an additional grafting was performed to cover more superficial peripheral defects. As described in early reports,[19,20] fasciocutaneous flaps with distal or proximal pedicles were also used, especially with wide pedicles (Figs. 3 and 4). The flap donor area was covered using a thin skin graft at the time of harvesting.

During the immediate postoperative period, low-molecular-weight heparin therapy was administered to all patients. At the time of discharge, heparin was replaced by either aspirin, in patients who underwent venous bypass or dilatation, or coumadin, in patients who underwent prosthetic bypass. Patients were maintained in the strict decubitus