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Biplanar flap reconstruction for pressure ulcers: experience in patients with immobility from chronic spinal cord injuries

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Rotational flap;
Axial flap;
Complication

Abstract

BACKGROUND: Surgical therapy for advanced-stage pressure ulcers recalcitrant to healing is a widely accepted practice. The present study examined the incidence of wound recurrence after reconstruction with fasciocutaneous versus combined (biplanar) muscle and fasciocutaneous flaps.

METHODS: A retrospective review identified 90 nonambulatory patients with spinal cord injury who underwent reconstruction for persistent decubitus ulcers from 2002 to 2008. Electronic medical records were surveyed for patient comorbidities and postoperative complications. Statistical methods included the Fisher exact test and the Mann–Whitney *U* test with a 2-sided *P* value of less than .05.

RESULTS: Among 90 patients reviewed, 33% (n = 30) received fasciocutaneous flaps and 66% (n = 60) underwent biplanar reconstruction. Comorbidities were the same between cohorts with the exception of a greater prevalence of diabetes in the biplanar group (27% vs 50%; $P < .05$). The incidence of recurrence for biplanar flaps (25%) was significantly lower than for fasciocutaneous reconstruction (53%; $P < .01$).

CONCLUSIONS: Biplanar flap reconstruction should be considered for chronically immobilized patients at high risk for recurrent decubitus ulceration.

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The management of pressure ulcers in patients with spinal cord injury is a complex problem. Paraplegic and quadriplegic patients have cutaneous anesthesia, resulting in no sensory warning of excess pressure below the level of injury. Common sites are usually over bony prominences because of prolonged continuous pressure.[1] The neural signals originate in the nociceptive afferent fibers, and these pathways are interrupted, leading to ischemia and tissue destruction.[2] There is a greater incidence of pressure ulcers in the paraplegic and quadriplegic populations secondary to prolonged confinement seen in the paralyzed patient.[3] The lack of mobility in the paraplegic and quadriplegic populations also leads to decubitus ulcers.

Nonsurgical efforts to heal wounds by pressure offloading, local wound care, and nutritional optimizations are first-line therapies; however, advanced pressure ulcers may require surgical intervention. The goals of surgery include

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the prevention of progressive osteomyelitis, elimination of necrotic soft tissues, and reconstruction using well-vascularized tissue. In addition to wound closure, flap reconstructions eliminates dead space while providing additional bulk. Surgical treatment of pressure ulcers leads to the reduction of protein losses, enhanced quality of life, decreased rehabilitation costs, and hygienic improvement.[3] The use of pressurized beds before and after surgery or a change of position every 2 hours are of paramount importance.

There are 2 main patterns of blood supply to the skin. The blood supply can come from the perforators, also known as *myocutaneous vessels*, which travel directly to the dermis from underlying muscles or from cutaneous vessels running parallel to the skin in the perifascial space. When a myocutaneous flap is harvested, it is composed of muscle, deep fascia, subcutaneous tissue, and overlying skin, all of which are perfused by a dominant vascular pedicle that is transferred in one surgical step. A difference between a fasciocutaneous flap and myocutaneous flap is that the fasciocutaneous flap does not have the same rich vascular supply as the myocutaneous flap. It mainly depends on the overlying skin, subcutaneous tissue, and deep fascia for its blood supply.[2] When part of a muscle is transferred for reconstruction, it provides a vascular supply to the overlying tissue.

In this study, biplanar flaps were used to treat pressure sores in which a transposed muscle flap provided bulk and padding to the defect but more importantly sealed the exposed debrided bone, and a fasciocutaneous flap was rotated to cover the rest of the wound. These types of flaps are not well described or studied in the literature. The present study directly compares the incidence of postoperative complications among fasciocutaneous and biplanar flaps consisting of fasciocutaneous reconstruction with a separate underlying muscle flaps.

Material and Methods

Patients wound characteristics

With approval from the Institutional Review Board at Edward Hines Jr VA Hospital a retrospective review of a prospective database was conducted to identify a single surgeon's experience with the surgical management of recalcitrant decubitus ulcers. All patients had chronic spinal cord conditions and were receiving care at a center of excellence known for treatment for chronic deep-tissue decubitus ulcers. Initial wound management involved debridement (surgical, mechanical, enzymatic), pressure relief, nutrition optimization, infection control, and counseling/social support. Patients were identified as surgical candidates with nonhealing stage 3 and 4 pressure wounds. Subjects underwent complete ulcer excision, partial ostectomy of boney prominence, and flap reconstruction. All instances of deep bone biopsies and cultures consistent with infectious osteomyelitis were treated with 6 weeks of intravenous antibiotics.

Patients were stratified according to method of reconstruction, with all subjects receiving either rotational fasciocutaneous only or rotational fasciocutaneous flaps plus muscle flaps and had advanced ulcers with deep wounds. For the procedure, the patient was placed in the prone or lateral positions depending on the location of the recurrent pressure sore. The wounds were cleaned and had partial ostectomies to create equalized pressure over boney prominences.

To create the biplanar flap, a gluteal muscle flap was elevated and transposed to cover the exposed bone. The muscle flap was sutured over the defect. A rotational fasciocutaneous flap then was created to cover the muscular transposition and the rest of the wound. Overall, the muscle flap plus the fasciocutaneous flap was placed without tension. Postoperatively, patients were maintained on Clinitron (Hill-Rom, Batesville, IN) weight distribution beds for a minimum of 6 weeks. In addition, all subjects were initiated on a sitting program consisting of graduated weight bearing over increments of time.

The surgeon performing the biplanar reconstruction was previously accustomed to using fasciocutaneous flaps as a standard method of repair for pressure ulcers as well described in the literature. The surgeon modified his technique in the later half of the study so that all patients who underwent pressure sore reconstruction had the addition of muscle to the fasciocutaneous flap. The elevation, accessibility, and easy dissection of a well-vascularized portion of muscle allowed for the creation of a biplanar flap. This method of reconstruction placed muscle over the exposed bone and generated enough bulk to decrease the dead space.

Electronic medical records were reviewed for patient demographics, comorbid spinal cord disease, surgical technique, incidence of recurrent decubitus ulceration, wound complications, and the need for reoperation. Statistical analysis was performed using GraphPad Prism 5 for Mac OSX (GraphPad Software, Inc., La Jolla, CA). Continuous variables were described as medians with minimum and maximum ranges. Normal distribution was assessed with the D'Agostino–Pearson omnibus K2 test; because not all data sets passed the normality test (á = .05), the Mann–Whitney *U* test was used for continuous variables. The Fisher exact test and the Pearson chi-square test were used for dichotomous categoric variables. A 1-tailed *P* value of less than .05 was considered significant.

Results

From 2002 through 2008, there were 90 chronically immobilized patients with spinal cord pathology who were identified with stage 3 or stage 4 decubitus ulcers requiring surgical management. Among this cohort, 64% were diagnosed with ischial ulcers (n = 58), 42% suffered from sacral decubitus ulcers (n = 26), and 29% had decubitus ulcers