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Salvage of Diabetic Foot by Skin Grafting: Our Experience

KEYWORDS: LEFT VENTRICULAR DYSFUNCTION,CHRONIC, KIDNEY DISEASE

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ABSTRACT *Ulcers are the leading cause of hospitalization in patients with diabetes mellitus and precede approximately 70–80% of all diabetic-related amputations (1, 2) . Timely healing and closure is critical to reducing the cost and morbidity associated with chronic diabetic lower extremity wounds (3–5). Split thickness skin grafts (STSG) are a well-known and widely accepted method for soft tissue coverage of open wounds (6). Historically, this technique has had a significant role in burn wounds and plastic surgery reconstruction, but has also been used successfully in the treatment of chronic diabetic foot ulcers (7–9). There are a vast number of wound care products and synthetic grafts available to the clinician today, but STSG remain the gold standard and may be considered a first-line treatment for lower extremity wounds associated with diabetes. Despite its common indications, there have been few large studies assessing the use of STSG as a modality for treatment of diabetic foot and leg wounds. Furthermore, few papers have examined the effect of individual patient risk factors on the healing time of STSG in the diabetic population. The aim of this retrospective review was to study the clinical use of STSG in a diabetic population and also identify any risk factors that may affect healing time or lead to complications.*

Materials and Method:

Patients who presented with diabetic ulcer were included in our study. Inclusion criteria included those patients who had a documented history of diabetes mellitus and an ulceration of the foot or leg distal to the tibial tuberosity. Patients were excluded from the study if they did not have a history of diabetes mellitus and/or less than 6 months follow up from the time of the application of the STSG. Patients with weight-bearing plantar ulcers were also excluded. 30 patients who met the inclusion criteria and were included in the study. Information regarding comorbidities and potential risk factors for healing was also collected from each patient's medical record including age, history of smoking, history of alcohol use, history of intravenous (IV) drug use, wound size, rheumatoid arthritis, end-stage renal disease, cardiac disease (coronary artery disease or congestive heart failure), peripheral vascular disease (PVD), history of fracture and history of Charcot neuroarthropathy.

Prior to application of the STSG, all patients underwent conservative local wound care with or without negative-pressure wound therapy in an attempt to promote a uniform granular wound bed with minimal wound exudate, fibrin, or slough. STSG application was delayed if there were any local signs of infection, malodor, purulent drainage, or edema. No STSG were applied directly over exposed bone, joint capsule or tendon. Any patient with questionable peripheral vascular status was referred to vascular surgery for workup and cleared prior to surgery. All STSG were performed in an operating room setting under either general or local regional anesthesia. Surgical preparation of the wound was achieved by sharp or mechanical debridement of all non-viable tissue from the wound bed and wound edges in a sterile environment. The wound was copiously irrigated with at least 1000 mL of normal saline and local hemostasis was achieved by a combination of direct pressure and/or topical thrombin. The wound was measured and the dimensions documented. All donor sites for patients in this study were from the anterior aspect of the ipsilateral thigh. The donor STSG site was then harvested utilizing a power dermatome set to 0.018-inch thickness and a width of two to four inches. For larger recipient areas, additional passes of the dermatome were made as needed in the same manner. The donor site was dressed with povidone-iodine soaked non-adherent gauze and sterile dry dressing. The STSG was then meshed in a 1:1.5 ratio and applied directly to the wound bed taking care to smooth any wrinkles and allow maximum apposition of the graft with the wound surface. The STSG was secured with staples around the edges under minimal tension and a non-adherent dressing was placed directly over the graft surface. In order to minimize graft migration and limit shear forces, a bolster dressing consisting of the foam portion of a surgical scrub brush and multiple layers of cast padding were secured firmly over the STSG. All patients were placed in a bulky splint until after the first post-operative visit. The patients were followed clinically at two weeks post-operatively and then on a weekly basis for dressing changes and to assess healing progress. One-week follow-up intervals were chosen in order to allow a quantifiable degree of healing to occur between clinic visits. Dressing changes consisted of re-application of the bolster dressing and roll gauze with continuation of the short leg cast or boot. Once healed, patients were seen in the outpatient clinic every four weeks until a minimum of 6 months follow up from the time of STSG application

The frequencies and mean time to healing were calculated for all variables of interest. Each variable was analyzed for healing time using a two-sample independent t-test. Analysis of variance (ANOVA) tests were also used to compare healing times. P values of less than 0.05 were considered significant.

Results:

A total of 80 consecutive diabetic patients met the inclu-

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sion criteria for this study ranging in age from 20 to 80 years. All 80 patients were available for follow up at 6 months. 80 STSG were applied in total, with 20/80 to the right foot, 28/80 to the left foot, 22/80 to the right leg and 10/80 to the left leg.

Case 1: Diabetic Foot : male 43 years

CASE 2: MALE PATIENT 52 YEARS:

DISCUSSION:

Despite success with STSG in surgery and wound care, there remain relatively few studies addressing its use in diabetic lower extremity wounds. In our study of diabetic patients, the mean time to complete wound healing was 12 weeks with a range 4-20 of weeks. This average is comparable to that of other studies of wound healing in diabetic populations. Recently, Ramanujam et al. retrospectively reviewed 83 diabetic patients treated with STSGs for diabetic foot and ankle wounds and reported a median time to healing of 6.9 weeks among those patients without complications [10]. Mahmoud et al. prospectively studied patients with STSG versus conservative wound care for diabetic foot wounds and found a statistically significant reduction in mean hospital stay and healing time for those patients treated with STSG [11]. They noted that 62% of all STSG patients had healed by week eight. Puttirutvong et al. compared the healing rates of meshed vs non-meshed STSG in 42 patients and found no significant difference [12]. The mean healing time for the meshed group was 19.84 and 20.36 days for the non-meshed group. Most STSG studies in non-diabetic studies report healing times between 2 and 4 weeks.

Impaired healing in diabetic patients is well-studied and can be attributed to multiple factors including impaired macro and microcirculation, peripheral neuropathy, endothelial dysfunction, and poor glycemic control [14–16]. One shortcoming of our study is that we did not quantitatively analyze preoperative glycemic control. However, Ramanujam et al. did not find a statistically significant difference in preoperative hemoglobin A1C levels and healing time, despite high average preoperative hemoglobin A1C values in their patients [10]. Conversely, a study by Marston found a direct correlation between hyperglycemia and wound healing. In this study, we found that the specific preoperative risk factors showed no effect on healing time [13]. Likewise, age, wound size, and wound location did not seem to have a significant effect on healing time.

Patients in our study with complications took longer to heal by more than 7 weeks on average than those without complications. Of the three patients who had complications, two had healing times of 10 weeks and the other had a healing time of 16 weeks.

CONCLUSION:

We conclude that autologous STSG are a safe and reliable treatment of non-healing diabetic foot and leg wounds.

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