

Skin and soft-tissue coverage for limb salvage in extensive diabetic foot ulcers: An institutional experience



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ABSTRACT

Background: Extensive diabetic foot ulcers (DFUs) with skin and soft-tissue defects need prompt coverage of the defect using plastic surgical means. The indication, timing, and techniques of wound coverage in DFUs are not adequately understood by all. Hence, an institutional experience of providing skin and soft-tissue coverage to extensive DFUs is reported. **Aims and Objectives:** The aims of this study were to study the various types of DFU that needs surgical wound coverage and to understand the types of wound coverage surgeries, their timings, success rates, and final outcomes. **Materials and Methods:** A retrospective-prospective study of all the DFUs managed using skin and soft-tissue coverage was conducted. Surgical and medical management and their outcomes were studied. **Results:** Sixteen patients underwent skin graft or flap surgery for their DFU. All the limbs were salvaged and all wounds were covered with two reports of ulcer recurrences. **Conclusion:** For optimal care of DFUs, the possible need for wound coverage, its timing, and aftercare are to be understood by all involved.

Key words: Diabetic foot; Wound coverage; Diabetic ulcer

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INTRODUCTION

Diabetic foot ulcer (DFU) has become a new age epidemic.¹ A delay in treatment can cause loss of skin and soft-tissue resulting in extensive wounds. Providing surgical coverage after wound optimization is hence, an important means of limb salvage. Skin grafts and flaps are the major modes of coverage. However, poor wound and limb conditions often pose a difficult decision-making with respect to the choice and timing of coverage surgery.² Although diabetic foot has been studied extensively from wound debridement to rehabilitation, coverage has not been described enough. We present here, our experience of managing extensive DFUs with wound coverage.

Aims and objectives

The aims of this study were to study the various types of DFU that needs surgical wound coverage and to understand

the types of wound coverage surgeries, their timings, success rates, and final outcomes.

MATERIALS AND METHODS

We conducted a retrospective-prospective study of all the DFUs managed using skin and soft-tissue coverage in our institution in the past 1 and 1/2 years. The inpatient and outpatient medical records, discharge summaries, and medical photographs were reviewed and follow-up surveys were conducted. DFU patients who did not undergo wound coverage and those who were not available for follow-up were excluded from the study.

The data were studied with respect to the patient demographics, duration of diabetes, duration of DFU,

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treatment given, and the coverage procedure employed. Outcomes were studied in terms of completeness of wound coverage, time taken for complete wound healing, duration of hospital stay, complications, and recurrence.

RESULTS

A total of 16 patients underwent wound coverage for DFU during this period. They included 11 males and five females. The age ranged from 52 years to 90 years with average of 74. All the patients belonged to low socioeconomic strata.

Duration of diabetes ranged from 40 years to few days. Nine patients were on oral hypoglycemics and six were advised insulin before the onset of the diabetic foot with one patient unaware of his diabetic status. None of the patients were regular in monitoring their sugar levels before the DFU and only half the patients gave history of strict adherence to the prescribed medications. Blood glucose levels were uncontrolled in all the patients studied. Three patients had GRBS more than 400 mg/dl with ketone bodies in the urine at the time of arrival to our hospital.

Duration of DFU at presentation to our hospital ranged from 6 months to 4 days. Five patients presented with pus and/or active infection and in sepsis, while 11 patients had a chronic non-healing ulcer with no signs of acute sepsis. Nine DFU were in weight-bearing part of the sole and seven patients had DFU in medial insole or dorsum of the foot. The ulcer bed included necrotic tissue in nine patients and unhealthy granulation tissue and scar in seven patients.

Five patients were seen to have significant reduction in the perfusion of the foot evidenced by color Doppler scan. Thirteen patients had poor or absent protective sensation in some part of the foot. Six patients had charcot joints. Total of ten patients had other callosities in the foot.

Primary treatment

All patients were treated as in-patients at presentation and mode of diabetes control was insulin on sliding scale, with dosage later fixed by the physician. Pus or wound swab was sent for culture/sensitivity in all patients. All patients underwent initial debridement. Ten patients underwent more than one debridement before the wound coverage surgery. Negative pressure dressing was used in eight patients. Protruding bony heads or bursae excised. Tight tendons were released or lengthened as the case necessitated.

Wound coverage surgery

Median duration from initial presentation to wound coverage surgery was 14 days. Modes of coverage were: Direct split-skin grafting (SSG) (Figures 1 and 2), SSG



Figure 1: Diabetic foot ulcers in medial insole



Figure 2: Split-skin grafting covering



Figure 3: Flap coverage

over integrated dermal regeneration template, and flap coverage. Flaps used were medial plantar artery flap, reverse sural artery flap, and lateral calcaneal artery flap (Figure 3).

Outcomes

Wound coverage was complete in all cases. Number of cases with more than 10% graft or flap loss was three cases. One patient had to undergo repeat surgery. There were no donor site morbidities. There were no mortalities. Nine patients were advised off-loading or protective foot wears.

Long-term results

After a minimum follow-up of 6 months, all patients were alive, and using the limb. Recurrence of the ulcer was noted in two patients. Only three patients were using protective foot wear. All patients were monitoring their feet for occult ulcers on daily basis.

DISCUSSION

DFUs present in many shapes and sizes.³ Two important features are acute infections often with abscess in sepsis and chronic non-healing ulcers. The former needs immediate medical and surgical intervention to prevent mortality as well as loss of precious tissue of the limb. However, when an amount of tissue is lost to infection, the right treatment is to replace the lost tissue to salvage the parts that are alive and functional. Plastic surgical coverage helps achieve the same.

The need for coverage is felt when a raw area is not expected to heal by secondary intention, when the resultant scar is not expected to be stable or strong enough or when important structures are exposed which need timely coverage.

Timing of wound coverage is important. As a prerequisite, all the devitalized and necrotic tissue has to be adequately cleared by good debridement. Bacterial load is minimized by use of frequent dressings of vacuum dressings and antibiotics as per culture-sensitivity. Adequate blood supply to the part is confirmed by color Doppler study. Vascular intervention may be considered in case of severe vascular inadequacy. The wound and patient as a whole is assessed for reduction in total leucocyte count, remission of edema, decrease in wound discharge, and appearance of healthy granulation tissue. Patient's general condition needs to be at optimal condition to undergo the procedure.

Modes of coverage

A granulating wound which is not weight-bearing needs no more than SSG. The spectrum of such wounds and the quality of the graft can be enhanced by the use of dermal templates like Integra. However, a wound that is expected to bear stress including that of weight-bearing can only be helped by a flap. The flap should be strong enough to bear the stress. Adjacent flaps like V-Y flaps or keystone flaps are

useful for small defects. Axial flaps in the foot are limited in number although prove invaluable when available. They include medial insole flaps in various fashions: cutaneous, musculo-cutaneous, proximally based, distally based, islanded, transposed or advanced, etc., Other axial flaps in the foot are lateral calcaneal flap, dorsalis pedis artery flap, etc., and microvascular free flaps are the last resort in limb salvage of diabetic foot. Poor quality of recipient vessels in diabetic feet makes them less preferred, although their utility in DFU is increasing.⁴

Long-term outcomes

Long-term outcome depends on the quality of the coverage, control of diabetes, and foot care. Protective sensation is an important factor in the durability of the coverage especially in weight-bearing parts. The patient and his family are often sensitized about proper diabetic at the end of the ordeal. Hence, it is to be utilized to gain better compliance in caring for the diabetic patient. Customized foot-wear with proper off-loading needs to be advised.⁵ Regular observation and care of the foot are encouraged.

In general, the early detection of DFUs and prompt treatment can prevent loss of skin and soft tissue. However, in cases with loss of skin and soft tissue, plastic surgical coverage helps salvage limbs.

CONCLUSION

DFUs with loss of skin and soft tissue can be helped by plastic surgical coverage of the wounds using the right technique, at the right time and with the right care.

REFERENCES

- Gupta S, Panda S and Singh S. The etiopathogenesis of the diabetic foot: An unrelenting epidemic. *Int J Low Extrem Wounds*. 2010;9(3):127-131. <https://doi.org/10.1177/1534734610380029>
- Donegan R. Factors maximizing skin flaps and grafts for diabetic wound coverage. In: Shiffman M and Low M, editors. *Pressure Injury, Diabetes and Negative Pressure Wound Therapy. Recent Clinical Techniques, Results, and Research in Wounds*. Vol. 3. Germany: Springer; 2018. https://doi.org/10.1007/15695_2017_48
- Jain AK and Joshi S. Diabetic foot classifications: Review of literature. *Med Sci*. 2013;2(3):715-721. <https://doi.org/10.5455/medscience.2013.02.8069>
- Özkan Ö, Coşkunfirat OK and Özgentaş HE. Reliability of free-flap coverage in diabetic foot ulcers. *Microsurgery*. 2005;25(2):107-112. <https://doi.org/10.1002/micr.20094>
- Maciejewski ML, Reiber GE, Smith DG, Wallace C, Hayes S and Boyko EJ. Effectiveness of diabetic therapeutic footwear in preventing reulceration. *Diabetes Care*. 2004;27(7):1774-1782. <https://doi.org/10.2337/diacare.27.7.1774>

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KP- Concept and design of the study, prepared first draft of manuscript; **GP**- Interpreted the results; both: Reviewed the literature and manuscript preparation; Concept, coordination, preparation of manuscript and revision of the manuscript.

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