

Role of Hybrid Reconstruction Ladder in Diabetic Ulcer

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Abstract

Diabetic foot ulcers is a devastating component of diabetes progression and are caused by loss of glycemic control, peripheral neuropathy, peripheral vascular disease, and immunosuppression. An estimated 15% of patients with diabetes have diabetic foot ulcers.¹ Hybrid endovascular and open reconstructions are used increasingly often for multilevel revascularization and management of lower limb ulcers, especially for lower limb ischaemia. In this study hybrid reconstruction was performed to improve outcome of wound healing in adult diabetic foot patient.

Keywords: Hybrid reconstruction, Diabetic foot ulcer.

INTRODUCTION

Type 2 diabetes accounts for 90% to 95% of cases worldwide and is due to genetic and environmental factors with resultant insulin resistance and pancreatic beta cell dysfunction. Complications arising from hyperglycemia can either be macrovascular or microvascular. The macrovascular disease affects mainly the cardiovascular and cerebrovascular systems, and

the microvascular disease includes nephropathy, retinopathy, and neuropathies. A debilitating complication of diabetes mellitus is diabetic ulcers, which leads to increased overall morbidity in patients. Patients with diabetes mellitus (type 1 or 2) have a total lifetime risk of a diabetic foot ulcer complication as high as 25%.²

Based on wound depth and necrotic tissue, diabetic ulcers can be classified by the Wagner ulcer classification system.³⁻⁵

Wagner-Meggitt Classification of Diabetic Foot

Grade 0 - Foot symptoms like pain, only.

Grade 1 - Superficial ulcers involving skin and subcutaneous tissue.

Grade 2 - Deep ulcers involving ligaments, muscles, tendons, etc.

Grade 3 - Ulcer with bone involvement.

Grade 4 - Forefoot gangrene.

Grade 5 - Full foot gangrene.

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METHODS AND MATERIALS

This study was conducted in tertiary care centre in department of plastic surgery after getting the department ethical committee approval. Informed consent was obtained for examination and clinical photography. A 72 years old male with diabetic ulcer of the left first web space (Fig. 1) was admitted and underwent hybrid reconstruction ladder therapy. He underwent multiple sessions

of hydrojet therapy, prolotherapy, insulin spray, Hemoglobin spray, phenytoin therapy, non cultured keratinocyte skin graft (from right groin), prolotherapy, closed incision negative pressure wound therapy, hydrojet debridement & regulated oxygen negative pressure therapy, perivascular Botox injection, autologous lipoaspirate therapy, autologous bone marrow therapy, heterografting (collagen) during his course in hospital. (Fig. 2-14)

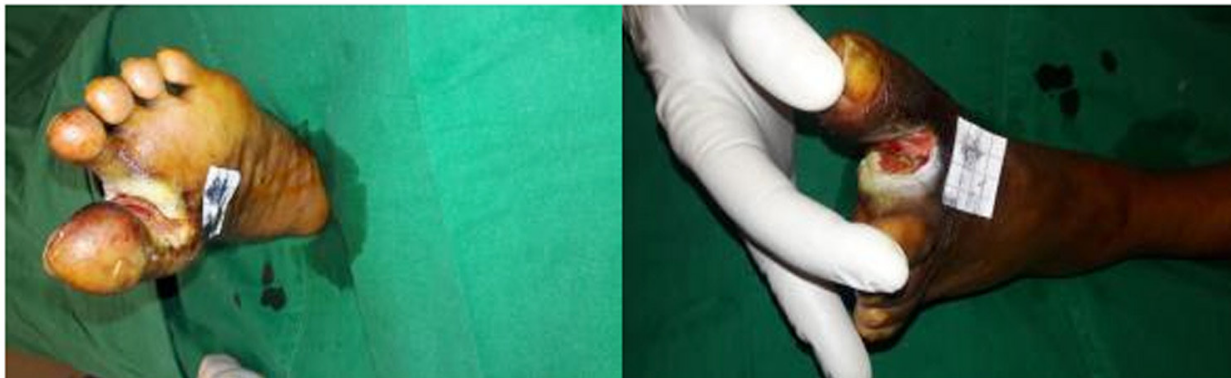


Fig. 1: Wound during admission



Fig. 2: Wound cavity filled with Collagen granules



Fig. 3: Hb- spray for wound bed preparation



Fig. 4: Autologous platelet rich plasma therapy



Fig. 5: Low level laser therapy



Fig. 6: Prolotherapy



Fig. 7: Hydrojet debridement and regulated oxygen negative pressure therapy



Fig. 8: Peri-vascular BOTOX injection



Fig. 9: Autologous lipospirotherapy - fat being harvested Autologous lipospirotherapy being given



Fig. 10: Autologus Bone marrow therapy - fat being harvested Autologus Bone marrow therapy being given



Fig. 11: Split thickness skin graft being harvested for Non cultured keratinocyte skin graft



Fig. 12: Closed incision negative pressure wound therapy



Fig. 13: Heterografting with collagen sheath



Fig. 14: Bio-silk dressing

RESULTS

After the multimodality hybrid ladder therapy, wound site healing improved and there was good

wound bed preparation for heterografting without any local adverse effects (Fig. 15). Patient was discharged after wound granulated & contracted.

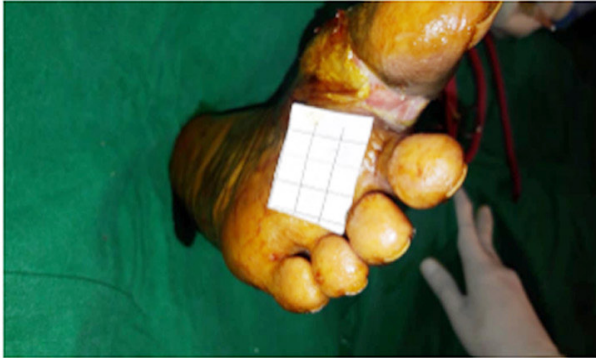


Fig. 15: Wound at the time of discharge

DISCUSSION

Foot soft tissue coverage poses a challenge to reconstructive surgeons due to the lack of donor sites for the specialized skin. This glabrous, tethered thick skin is designed to withstand the stress of weight bearing and is hard to replace. The limited arch of rotation of foot local flaps adds up to further difficulties. A case series published in December 2021 involved 8 patients with foot ulcer who were treated with hybrid reconstruction ladder and showed promising results. Literature shows that technique escalation in accordance with the ladder should be undertaken based on wound etiology, presentation, extent and nature of tissue loss, available resources, and surgeon expertise.⁶

Treatment approach with the hybrid reconstruction ladder involves starting at the bottom of the ladder and escalating up if one therapy fails to improve the wound. The hybrid reconstruction ladder is a recent advancement in plastic surgery, which is originally a modification of the conventional reconstructive ladder. Insulin, phenytoin, autologous bone marrow aspirate, autologous lipoaspirate, biosilk, Hb are some of the materials we used in our study for reconstruction. Hemoglobin spray consists of purified hemoglobin and is a novel approach to increase oxygen concentration in wound bed in diabetic foot ulcer patients. Its mode of action is binding to atmospheric oxygen and diffuse into wound bed to accentuate wound healing, especially in chronic non-healing wounds. Overall, the hybrid reconstructive ladder is still under development and could be the first line therapy in the treatment of wounds in upcoming years.

CONCLUSION

Hybrid reconstruction ladder is an important alternative in the treatment of multilevel arterial disease among patients with chronic and acute foot ulcers. Success of these procedures depends mainly on the pathology of the ulcer. The performance of simultaneous hybrid procedures is associated with potential advantages such as decrease in length of hospital stay, better wound healing and preparation of wound bed for definitive therapy later, such as split skin grafting. In our study the multimodality approach to treatment of diabetic ulcer was found to improve ulcer healing and promoted wound bed preparation for grafting.

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