

## Role of Hybrid Reconstructive Ladder in SCC

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### Abstract

Complex wounds pattern has initiated efforts to create new and innovative techniques in tissue regeneration. Multidisciplinary team has effectively adapted advanced reconstructive techniques merged with regenerative medicine modalities to improve outcomes in complex reconstruction. These treatments combine traditional reconstruction measures with regenerative medicine applications and has been termed 'Hybrid reconstruction ladder'. This review article gives an overview about hybrid reconstruction ladder in management of squamous cell carcinoma.

**Keywords:** Squamous cell carcinoma; Hybrid reconstruction ladder; Regenerative therapies.

## INTRODUCTION

Plastic surgery has undergone gradual evolution over time, the basic concept of methods of reconstruction ranked by complexity has been preserved and propagated in multiple forms. Most descriptions start with closure by secondary intention, followed by direct closure, local flaps, and distant flaps. Various authors have made finer distinctions among local, regional, and free flaps, and inserting tissue expansion somewhere in the spectrum.<sup>1,2</sup> The complex wound pattern has initiated efforts to create new and innovative techniques in tissue regeneration. Multidisciplinary team has effectively adapted

advanced reconstructive techniques merged with regenerative medicine modalities to improve outcomes. These treatments combine traditional reconstruction measures with regenerative medicine applications and has been termed hybrid reconstructions. The hybrid reconstruction model (Fig. 1) aids in maximizing the function while minimizing the disability and morbidity associated with traditional reconstruction.

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Fig. 1: Hybrid reconstruction ladder

## MATERIALS AND METHODS

In this case report, 32 year old male came to JIPMER Hospital with the chronic non healing ulcer over the lower back of size 5 X 5 cm for past 10 year post electrical burns (Fig. 2). After wide local excision of the ulcer histopathology report came as Squamous cell carcinoma with all margins negative for tumor. After tumor removal size of the tumor ulcer size was around 8 x 8 cm (Fig. 3). In view of scarred tissue all around the ulcer, local keystone flap based on the perforator on the right side of the ulcer and transposition flap on left side of the ulcer was planned. The scarred tissue over back and around the ulcer caused due to electrical burns in this patient, causing limitations in the management of the ulcer. After assessing the perforator on one side of the defect, part of the defect was covered with keystone perforator flap and other half of the defect is covered with transposition flap after delay. The

raw area created post local flaps from the donor site was covered with split skin grafting from the left thigh. The transposition flap underwent necrosis at the distal most part of the flap and it was debrided and underwent collagen dressing and negative pressure wound therapy followed by skin grafting applied (Fig. 4-6). Post-operative care for the flap and skin graft was done with innovative ring splint made from cotton roll and pad made into a ring and fixed around the flap site so that even if the patient lies flat flap site was protected by the splint from direct pressure over the skin grafted site. Autologous platelet rich plasma, Dry collagen scaffold dressing, Prolotherapy, Centella extract application, Negative pressure wound therapy, Low level laser therapy (Fig. 7-12) was used in the preparation of wound bed and for better flap and skin graft survival. The wound healed well at the time of discharge (Fig. 13).



**Fig. 2:** Non healing ulcer over lower back at the time of admission.



**Fig. 4:** Keystone flap on right side of defect



**Fig. 3:** Post resection of squamous cell carcinoma- Raw area



**Fig. 5:** Transposition flap delay on the left side of the raw area



Fig. 6: Post transposition flap



Fig. 7: Necrosis at the distal part of transposition flap



Fig. 8: Collagen scaffold dressing for the remnant raw area



Fig. 9: Negative pressure wound therapy for the wound



Fig. 10: Autologous platelet rich plasma in wound bed preparation



Fig. 11: Centella extract application for wound bed preparation



Fig. 12: Low level laser therapy application for wound bed preparation.

## RESULTS

Wounds which are difficult to reconstruct and healing are approached effectively with hybrid reconstructive ladder. It helps in fasten the healing rate and the patient has good compliance with the regenerative therapy. The regenerative medicine plays a major role in the hybrid reconstructive ladder and it helps in rescue the patients when the reconstructive options for the patients are limited.

## DISCUSSION

The reconstructive ladder was a term coined by plastic and reconstructive surgeons to describe levels of increasingly complex management of soft tissue wounds. Theoretically, the surgeon would utilize the lowest part of the ladder - that is, the simplest reconstruction technique - to address a clinical reconstructive problem. The reconstructive surgeon would move up the ladder as a more complex or suitable method was required for a given reconstruction problem.<sup>3,4,5</sup> In this case as the patient is a known case of chronic non healing ulcer post electrical burns with scarring with biopsy came as squamous cell carcinoma. The patient underwent local flap cover based on perforator. A hybrid reconstructive ladder that augments the traditional reconstructive ladder with regenerative medicine modalities. There were improved outcomes at each step on the reconstruction ladder



Fig. 13: Healed wound at the time of discharge

and these modalities may allow for the expansion of indications for each step on the reconstruction ladder. The study effectively employed dermal regenerates, soft tissue regeneration techniques, biologic scaffolds<sup>6</sup>, fat grafting techniques and adipose-derived stem cells in a number of reconstructions. Dry collagen was used as a scaffold for tissue regeneration of the wound bed for further intervention.<sup>6,7</sup> Prolotherapy believe that the injection of hypertonic dextrose causes cell dehydration and osmotic rupture at the injection site that leads to local tissue injury that subsequently induces granulocyte and macrophage migration to the site, with release of the growth factors and collagen deposition. In vitro studies have shown that even concentrations as low as 5% dextrose have resulted in the production of several growth factors critical for tissue repair. Some of these growth factors include PDGF, TGF- $\beta$ , EGF, b-FGF, IGF-1, and CTGF.<sup>8</sup> The reconstructive grid is a dynamic construct that takes into account the multiple reconstructive options available to the plastic surgeon. It also takes into consideration factors that help the reconstructive surgeon determine the best possible option to achieve the three reconstruction goals, namely, form, function, and aesthetics. The factors that aid the judgment of a reconstruction specialist, including wound complexity, surgeon skill, resources (and technology) available, and patient requests, form the boundaries of the reconstructive grid. Low Level Laser Therapy (LLLT) is one of the proposed modalities to improve wound healing and scar quality. LLLT is claimed to increase collagen synthesis, decrease inflammation and has a positive impact on scar remodeling. Negative Pressure Wound therapy (NPWT) involve removal of exudates and infectious materials and contraction of wound margin. NPWT has been shown to be safe and effective in post debridement wounds.<sup>9</sup> Hence NPWT was started,

and size of the wound was measured at the time of change of dressing. Platelets act as regulators of inflammation, angiogenesis, cell migration, and proliferation with the release of various growth factors and anti-inflammatory cytokines which is thought to help in faster and better healing of the wounds. Autologous platelet rich plasma (APRP) has growth factors which when injected in the wound site or sprayed, act at the intracellular level to bring about cell proliferation and healing of a wound. All extracts of *Centella asiatica* facilitate the wound healing process in both incision and burn wounds. Asiatic acid in the ethyl acetate extract seemed to be the most active component for healing the wound.<sup>10</sup>

## CONCLUSION

The application of regenerative medicine therapies in the treatment of complex reconstruction post resection of squamous cell carcinoma has significantly aided in improving reconstructive outcomes. Hybrid Reconstruction Ladder is continuing to evolve and may become the standard of care for effective management of composite tissue wounds. This has to be applied to the multiple number of cases for the assessment of the hybrid reconstructive ladder in complex wounds created post squamous cell carcinoma resection for identifying the limitations.

**Conflicts of interest:** None

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