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Role of Sromal Vascular Fraction (SVF) in Wound BED Preparation (WBP) in Post Traumatic Wound

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Abstract

Degloving Injury are major debilitating conditions and its treatment is also challenging. The treatment of post traumatic degloving injury requires a multimodal approach. Adjuvant platelet rich fibrin matrix can be tried for post traumatic wounds as a modality for wound bed preparation. In this study we share our experience regarding the use of stromal vascular fraction as an adjunct in the management of post traumatic degloving wounds of the lower extremity.

Keywords: Degloving Injury, Post-Traumatic Wounds, Stromal Vascular Fraction (Svf), Wound Bed Preparation, Lower Extremity

INTRODUCTION

Skin avulsions and soft tissue injuries to the bone are both examples of post-traumatic degloving injuries. These wounds can occur everywhere on the body, although the extremities, trunk, scalp, face, and genitalia are the most often affected areas. The majority of these patients also have secondary injuries as a result of polytrauma, which includes significant blood loss, and the degloved skin and soft tissue are frequently practically dead. If degloving injuries are not identified quickly, there will be more morbidity and mortality. Various management techniques are described based on the wounded place. According to recent research, treating non-healing ulcers using autologous stromal vascular fraction that is rich in growth factors is successful.[1] In our study we used stromal vascular fraction (SVF) as an adjunct for preparing wound bed in the management of post traumatic degloved injury.

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MATERIALS AND METHODS

This study was conducted in the department of Plastic Surgery at tertiary care centre after getting the departmental ethical committee approval. Informed written consent was taken from the patient. This is the prospective observational study about a 60-year-old male came wit with no known co morbidities. He met with RTA (road traffic accident)5 months back with post traumatic wound of the left lower limb for which serial debridement was done by primary centre before referring to our centre. At admission patient presented to plastic surgery department with extensive raw area over the left lower limb extending from just knee to dorsum of foot.

Stromal vascular fraction (SVF) was used for the wound bed preparation.

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1. 20 ml of floating lipoaspirate was poured into containers with no more than 4 mL of Phosphate buffer Solution. The bottles were vigorously shaken by hand for approximately 1-2 min with Phosphate Buffer Solution.
2. Then the tubes are allowed to settle down till the layers get separated – oil layer, fatty layer, infranatant layer (aqueous layer containing SVF pellet at the base).
3. The adipose tissue was separated, the aqueous infra-natant was saved in 10 conical tubes. The Adipose tissue was washed for another 2-3 times, each time saving the infranatant. The adipose tissue can be processed and can be used separately.
4. The conical tubes with the infra-natant were centrifuged at 1200 rpm for 5 min at room temperature.
5. The SVF pellet will be noted at the lowermost layer in centrifugation tube.

The SVF was transferred to the raw area and covered with a sterile dressing and applied over the wound. Two sittings were done one week apart and the wound bed was reassessed after 2 weeks.

RESULTS

After 2 weeks, the wound bed got ready with appearance of healthy granulation tissue. The future plan is to cover the raw area with skin grafting.

Figure 1: Wound at presentation

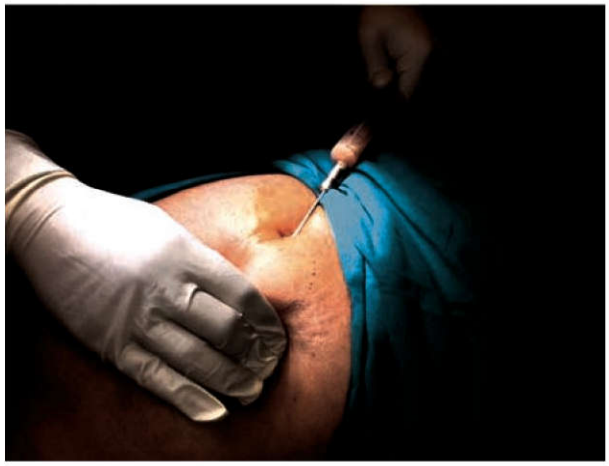

Figure 2: Liposuction done to obtain adipocytes

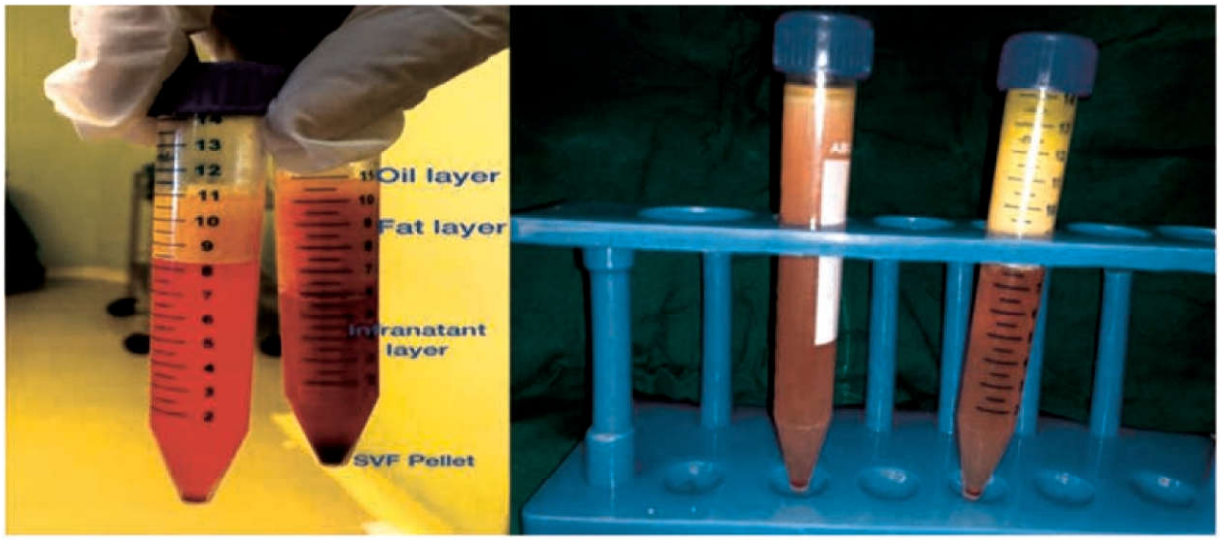

Figure 3: SVF Preparation

Figure 4: SVF applied over the rawarea

Figure 2: Wound bed with appearance of healthy granulation tissue

DISCUSSION

Degloving soft tissue injuries are severe and may be fatal. Early identification and treatment are necessary. A strong index of suspicion is still essential, particularly in the care of closed injuries. Usually, a multidisciplinary approach is required. To properly care for such individuals, early repair and efficient rehabilitation are also imperative. Studies that span multiple disciplines and institutions are necessary. Lower-limb degloving injuries can have a complicated and time-consuming course of treatment. It may be necessary to use artificial dermal replacement, cryopreserved split-thickness skin grafts obtained from degloved flaps, or VAC therapy for lower limb degloving injuries. Stem cells have the ability of self-renewal and differentiation into various cell lines, which provides the possibility of early angiogenesis of the skin flap.[2,3,4] In recent years, the safety and effectiveness of human-derived stem cells used in clinical and preclinical studies have been confirmed.[5] Cell based therapy is rapidly emerging as a part of wound management, but is seldom used alone. These cells can be harvested from bone marrow or adipose tissue. The clinical use of autologous adipose-derived stem cells (ASCs) is rapidly expanding. They are being used in myocardial infarction, cosmetic surgery, osteoarthritis and bone regeneration [6], inflammatory bowel disease and chronic wounds. ASCs demonstrably survive after transplantation, show pluripotential and exhibit anti-apoptotic, anti-inflammatory and pro angiogenic effects. These cells have the capacity of differentiation into endothelial cells and secretion of endogenic growth factor that contribute to increased neovascularization. Stromal vascular fraction (SVF) is a heterogeneous mixture of cells resulting from the mechanical or enzymatic processing of aspirated adipose tissue and can be prepared by two methods.[7,8]

1. **Enzymatic**

   This process is based on enzymatic digestion of lipoaspirate by collagenase. The digested adipose tissue is centrifuged, which separates the processed lipoaspirate into three main layers, the oil/adipose tissue layer, the aqueous layer, and the pellet. The SVF is contained within the pellet, so the other layers are discarded.

2. **Mechanical method**

   Mechanical methods seek alternative non-enzymatic means of removing SVF cells from the adipose tissue and tend to be focused around washing and shaking/ vibrating lipoaspirate followed by centrifugation in order to concentrate the SVF cells. There are automated and semi-automated systems which are able to carry out each step of the process with little or no interference from a technician.[9]

The purpose of this case report is to provide clinical evidence for the effectiveness of stem cell therapy in the form of stromal vascular fraction to prevent flap necrosis. The growth factors in SVF are involved in all three phases of wound healing and have an impact in preventing flap necrosis. In the first phase of wound healing (inflammatory phase), SVF decreases the levels of mast cells and myofibroblasts through immunosuppressive and anti-inflammatory effects, leading to reduced active scar formation. In the proliferative phase of wound healing, the differentiation of adipose-derived stem cells and numerous growth factors contained in SVF helps in improved angiogenesis.[10] In the

maturation phase, excessive collagen synthesis is suppressed, and remodelling of collagen is induced by chemokines such as (TGF: transforming growth factor) beta 3 and matrix metalloproteinases. The presence of growth factors (i.e., PDGF: platelet-derived growth factor), (IGF: insulin-like growth factor), (KGF: keratinocyte growth factor), (b FGF: basic fibroblast growth factor), and vascular endothelial growth factor [VEGF] accelerates angiogenesis and improved flap microcirculation. Flap necrosis mainly happens through insufficient perfusion, venous return disorder, and ischemia reperfusion injury.[11] Improvement in local neovascularization and increasing blood supply to ischemic tissues prevent flaps from getting necrosed. Angiogenesis in skin flaps is an intricate process involving the coordination of various cells and cytokines. The ability of stromal vascular stems cells to produce endothelial growth factors and induce angiogenesis is exploited in their use to prevent flap necrosis.

CONCLUSION

This is a preliminary study to assess the use of SVF in Post traumatic wound as wound bed preparation. A large multicentric, double blinded control study with statistical analysis is required to further substantiate the results.

Conflicts of interest: None

Authors' contributions: All authors made contributions to the research, is putatively expected to be useful article.

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