Role of Platelet rich fibrin matrix as an adjunct in the management of degloving injury raw area

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

Keywords: Degloving injury, Platelet rich fibrin matrix, Wound bed preparation.

Introduction
Degloving soft-tissue injuries are a form of avulsion of soft tissue, in which an extensive portion of skin and subcutaneous tissue detaches from the underlying fascia and muscles. These injuries can affect any part of the body but it usually effects the extremities, trunk, scalp, face and genitalia. In addition to the local tissue injuries, most of these patients have other injuries as part of polytrauma with massive blood loss and the degloved skin and soft tissue are often effectively dead.

Degloving injuries if not recognised early will lead to increased morbidity and mortality. Various management procedures are described according to the site injured. Recent literature has shown autologous platelet-rich fibrin matrix being rich in growth factors is effective in the treatment of non-healing ulcers. Here we have used platelet rich fibrin matrix (PRFM) as an adjunct in the management of degloving injuries where in the donor site for acquisition of graft is limited.

Materials and Methods
This study was conducted in the department of Plastic Surgery at tertiary care center after getting the departmental ethical committee approval. Informed written consent was taken from the patient. The details of the patient in study are as follows: 37-year-old female with no known co morbidities with h/o road traffic accident 4 months back and underwent right below knee amputation due to vascular injury and degloving injury of the left lower limb for which serial debridement was done in cardiothoracic and general surgery department. Now, the patient presented to plastic surgery department with extensive raw area over the left lower limb and non-healing ulcer over the right below knee amputation stump. Multiple debridement was done and STSG was done over the raw areas in multiple settings.

Wound bed preparation was done using various modalities. PRFM was used for the remaining raw area (Fig. 1). Under strict aseptic precautions, ten ml of venous blood was drawn, added to a sterile centrifugation tube devoid of anticoagulant. Centrifugation was done at 3000 rpm (approximately 400 g) for 10 minutes. Three layers were obtained: upper straw-coloured platelet poor plasma (PPP), red-coloured lower fraction containing red blood cells (RBCs) and the middle fraction containing the PRFM. The upper straw-coloured layer (PPP) was discarded. PRFM was separated from red corpuscles at the base using a sterile forceps and scissor, preserving a small RBC layer measuring around one mm in length, which was transferred onto a sterile gauze (Fig. 2). The PRFM was transferred to the raw area and covered with a sterile dressing (Fig. 3) Two sittings were done one week apart and the wound bed was reassessed 2 weeks. The wound showed healing as evidenced by healthy

granulation tissue. This was repeated once every 3-5 days when the dressing was changed. The wound was reassessed after 2weeks for evidence of wound healing. The wound showed healing as evidenced by healthy granulation tissue (Fig. 4).

Fig. 1: Wound before application of PRFM

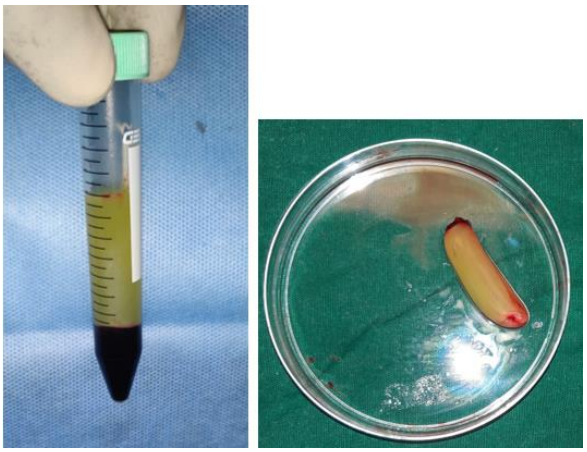

Fig. 2: Platelet rich Fibrin Matrix

Fig. 3: PRFM being applied.

Fig. 4: Wound after application of PRFM

Results

The use of platelet rich fibrin matrix use in the raw areas of degloving injury helped in expediting the healing of wound. Some of the raw areas were completely healed and the remaining were prepared for STSG.

Discussion

Degloving soft-tissue injuries are serious and potentially devastating. They require early recognition and early treatment. In the management of closed injuries in particular, a high index of suspicion remains crucial. A multidisciplinary approach is usually needed. Early reconstruction and effective rehabilitation are also essential to care for such patients. There is a need for multi-disciplinary and multi-institutional studies.

The management of lower-limb degloving injuries can be complex and quite involved. In recent years, use of a vacuum assisted closure (VAC) device to prepare the wound bed for grafting has become standard practice.[1] Occasionally, lower limb degloving injuries require cryopreserved split-thickness skin grafts procured from degloved flaps, artificial dermal replacement, or VAC therapy.

Platelets have an important role in haemostasis[2] and also in wound healing process. Platelets release cytokines as well as growth factors,[3] which enhance the migration, proliferation, and functions of keratinocytes, fibroblasts, and endothelial cells. Chronic wounds

slowdown in the inflammatory phase of healing. They lack the growth factors and do not heal. Platelet derived autologous products, platelets rich fibrin (PRF) and platelet rich plasma (PRP) are a source of growth factors. The application of platelet- rich-derived therapies is useful in this regard.

Fibrin is an active form of Fibrinogen[4]. Fibrinogen is changed to insoluble fibrin by thrombin with a role in platelet aggregation. Platelet concentrates often lack coagulation factors, termed platelet-rich fibrin (PRF) was developed for the anticipated properties in tissue regeneration and wound healing. During centrifugation, fibrinogen gets concentrated in the upper region of the tube and is combined with thrombin to form a fibrin clot. The release of these factors commences 5-10 min after clotting and continues for at least 60-300 min, providing a slow sustained release.[5]

PRF is made of a fibrin matrix gel which is polymerized in a tetra molecular structure, with platelets, leucocytes, cytokines, and circulating stem cells.[6] PRF has distinct advantages over PRP. The technique of PRFM preparation is easier, involves minimal handling, and is not dependent on anticoagulant or thrombin activator. The things required are easily available in a hospital. The gel form of PRFM is easier to apply on the raw area compared to the liquid formulation of APRP.[7] The activity of the autologous growth factors and biomechanical stiffness of plasmatic proteins after fibrin formation offer a unique architecture that helps in healing process. The growth factors from the alpha-granules of the activated platelets, and others such as fibrin, fibronectin and vitronectin play important role in tissue repair. These growth factors include vascular endothelial growth factor (VEGF), fibroblast growth factor-b (FGFb), PDGF, hepatocyte growth factor (HGF), EGF, and angiopoietin-I (Ang-I).[8]

Conclusion

This is a preliminary study to assess the use of platelet rich fibrin matrix in wound management in a limited setting with limited number of cases, but yet it has shown to be effective in the management of degloving injury raw area. A large multicentric, double blinded control study with statistical analysis is required to further substantiate the results.

Source of Funding

None.

Conflict of Interest

None.

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