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Original Article

Role of Tri-layer Scaffold in Wound bed Preparation in Necrotizing Fasciitis

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Abstract

Necrotizing fasciitis is an infection of subcutaneous tissue and fascia which may spread rapidly to deeper tissue and surrounding tissue which may cause damage to the tissue and present as a localized infection and fulminant septic shock with high mortality rate. The patient will undergo extensive debridement for the removal of necrotic tissue which creates extensive huge raw area and Scaffold has been found to be effective in wound bed preparation. This study highlights our experience in wound bed preparation using scaffold as an adjuvant in a case of necrotizing fasciitis.

Keywords: scaffold; wound bedpreparation; necrotizing fasciitis.

INTRODUCTION

Necrotizing soft tissue infections (NSTIs) include necrotizing forms of fasciitis, myositis, and cellulitis. These infections are characterized clinically by fulminant tissue destruction, systemic signs of toxicity, and high mortality.[1] Accurate diagnosis and appropriate treatment must include early surgical intervention and antibiotic therapy. Several different names have been used to describe the various forms of necrotizing infections; this is related in part to naming based on clinical features rather than surgical or pathologic findings. The degree of suspicion should be high since the clinical presentation is variable and prompt intervention is critical. The lay press has referred to organisms that cause NSTI as flesh-eating bacteria.[2] There is sufficient evidence to conclude that healing of necrotizing fasciitis is accelerated by scaffold. Though it is well-established therapy in the armamentarium of wound management, its role in wound bed preparation before cover by skin graft or flap has not been studied well. The Scaffolds has been found to be effective in wound bed preparation. This study highlights our experience in wound bed preparation using tri-layer biological scaffold in a case of necrotizing fasciitis.

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MATERIALS AND METHODS

This study was conducted in the department of plastic surgery in a tertiary care center after obtaining the departmental ethical committee approval. Informed written consent was taken from the patient. The study is a prospective observational type done on a 60 year old male with known co-morbidities including hypertension & coronary artery disease with ejection fraction of 25%. Patient presented with raw area (Figure 1) over left lower limb & perineum of one month duration. He was apparently well one month back when he developed multiple blebs over left lower

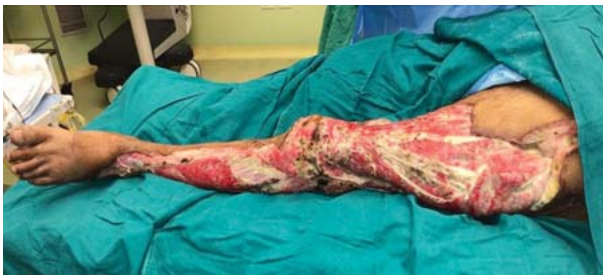

Fig. 1: At admission with raw area after extensive debridement of necrotizing fasciitis of left lower limb.

limb & perineum which ruptured leaving raw area with rapid progression of wound infection with foul smelling discharge. He was diagnosed with clinically as a case of necrotizing fasciitis. He underwent multiple debridement in referral surgery department after that he was referred to department of plastic surgery for further wound care. There are various modalities of regenerative wound care out of which here we used tri-layer scaffold (Figure 2) as a regenerative modality for wound care. After debridement, biological coverage of the raw area of the wound was done with scaffold. Written informed consent was obtained from both the parents. The regeneration scaffold was prepared in the department of plastic surgery using materials already available in the department.

Fig. 2: Tri layer scaffold

The three layers from outer to inner are as follows (Figure 2)

1. Silicone
2. Collagen
3. Amniotic membrane

Amniotic membrane was harvested from the obstetric department of the same institution. The amniotic membrane was taken from a healthy woman, who had a healthy pregnancy, who was screened for hepatitis B and C, HIV 1, 2 and VDRL, taken after a cesarean birth. The amniotic membrane was irrigated with saline and treated with heparin, antimicrobial, antifungals and glycerol under refrigeration.

Steps of preparation:

All the three layers from out to in were placed one over the other and sutured together using absorbable undyed 4.0 polyglactin sutures. The three-layer regeneration scaffold was applied once a week under anesthesia after debridement (Figure 3) and the patient was treated with antibiotics according to culture and sensitivity and also nutritional suppo

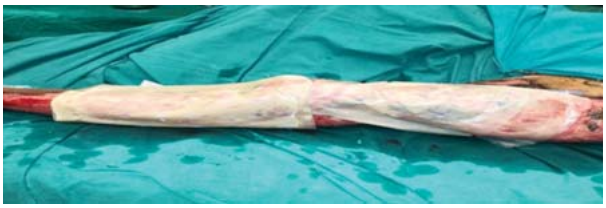

Fig. 3: Tri-layer scaffold application over the wound

RESULTS

The Tri-layer regeneration scaffold is effective in regenerating the wound following necrotizing fasciitis. The wound granulated well (Figure 4) and planned for wound cover with skin grafting.

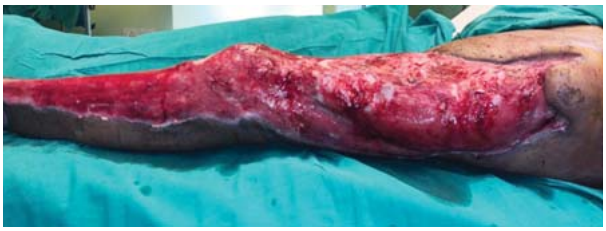

Fig. 4: Wound bed with healthy granulation tissue

DISCUSSION

Necrotizing fasciitis is a rare but life-threatening condition, with a high mortality rate (median

mortality 32.2%) that approaches 100% without treatment. Numerous conditions are associated with this pathology, such as diabetes mellitus, immunosuppression, chronic alcohol disease, chronic renal failure, and liver cirrhosis, which can be conductive to the rapid spread of necrosis, and increase in the mortality rate. The diagnosis of NF is difficult and the differential diagnosis between NF and other necrotizing soft tissue infections more so. However, the clinician should do their utmost to secure the diagnosis of NF, as a delay in diagnosis can be fatal, and septic shock is inevitable if the disease remains untreated. The characteristic of NF is the clinical status change over time. The early clinical picture includes erythema, swelling, tenderness to palpation, and local warmth; once the infection develops, the infection site presents skin ischemia with blisters and bullae. The diagnosis of NF can be secured faster with the use of laboratory-based scoring systems, such as the LRINEC score or the FGSI score, especially in cases of Fournier's gangrene. However, the diagnosis is definitely established by performing explorative surgery at the infected site.[1,2]

Management of the infection begins with antibiotic treatment. In the majority of cases with NF (70–90%) the reasonable pathogens are two or more, suggesting the use of broad-spectrum antibiotics. The value of antibiotic treatment in NF is relatively low, and early and aggressive drainage and debridement is required. In NF of the extremities, the clinician should consider amputating the infected limb, although this will not reduce the risk of mortality. Finally, postoperative management of the surgical wound is important, along with proper nutrition of the patient. If larger parts of the total body surface area have been involved, we usually use autologous skin grafts meshed to enlarge the size of the graft. The disadvantage of such practices is morbidity, like pain at the donor site, corrugated scar as the recipient site. In cases of total or near total full thickness injuries, donor site may be inadequate. In that case, other treatment option like allograft, heterograft were used. Such allograft represents temporary measures for immediate wound coverage in the acute stages post-injury. Tissue-engineered skin grafts aim toenable complete and natural and accelerated wound regeneration.[3] One of the major applications of scaffolds in plastic and reconstructive surgery is in the healing of cutaneous wounds. The natural embryogenesis and regeneration of tissues should be considered when designing biodegradable scaffolds.[3,4] Regeneration is tissue-dependent, and epithelial tissues and their basement membrane regenerate only when the stroma is intact or has itself been repaired. Various scaffolds can be used as advanced wound dressings that expedite wound healing, by not only covering the wound and providing a barrier against bacterial contamination, but also supporting the host tissue fibroblasts and keratinocytes.[5] Currently, scaffolds have been approved for the treatment of partial- and fullthickness wounds, pressure ulcers, diabetic foot ulcers, chronic vascular ulcers, surgical wounds, venous lower extremity ulcers, and burns. These products can be cellular or acellular. Particularly of note is Integra (Integra LifeSciences Corp., Plainsboro, N.J.), a bilayer consisting of a dermal replacement material, cross-linked collagen, and glycosaminoglycan hydrogel, covered by a silicone membrane (Fig. 4, left). The silicone membrane acts as a temporary dressing that keeps the wound moist and prevents bacterial contamination.[6] The dermal replacement layer acts as the scaffold, which allows formation of neo dermis. Consequently, the scaffold acts both as an adjunct to wound healing but also as a skin substitute and has been used in the treatment of burns and chronic wounds.[7] Studies have shown that use of Integra Dermal Regeneration Template in the treatment of chronic diabetic foot ulcers decreases the time needed for complete wound closure, increases the rate of wound closure, and decreases adverse events compared with standard care. Likewise, AlloPatch Pliable (Musculoskeletal Transplant Foundation, Edison, N.J.) applied to nonhealing diabetic foot ulcers reduced healing times and increased healing rates, with no reported increase in adverse events compared to standard care. Skin substitutes have also been developed from porcine urinary bladder. For example, MatriStem (ACell, Lafayette, Ind.) is developed by sterilizing porcine urinary bladder with electron beam radiation, resulting in a non–cross-linked acellular dermal matrix with an intact basement membrane that allows for normal cell attachment. Consequently, the scaffold facilitates wound healing through promotion of cellular proliferation and angiogenesis. Such scaffolds offer many advantages. In addition to being easy to administer, scaffolds have been shown to decrease the overall time to wound closure and the rate of incomplete healing.[8] Composite scaffolds are a combination of permanent and degradable materials into a scaffold. Ideally, these materials have the advantages of biological integration combined with the long-term structural integrity of permanent biomaterials. Several composite scaffolds have been developed, including a monofilament mesh composed of absorbable poliglecaprone and nondegradable polypropylene,

addition of nonbiodegradable poly (methyl methacrylate) or high-density polyethylene to composite bone cements, and polymer–bioceramic mixtures, all of which offer specific advantages.[7,8]

In our study we used indigenously made triple layer scaffold with locally available materials at less cost, which is compatible, non-allergic and non-immunogenic to the patient.

CONCLUSION

The three-layer regeneration scaffold is simple, cost effective, easy to prepare, and without any complications. Multi-center and larger volume study is required to comment on the exact findings.

Conflicts of interest: None

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Availability of data and materials: Not applicable.

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