REVIEW ARTICLE

Management of Donor Site a Bygone Area in Split-skin Grafting

Divya Kumar[1], CP Ganesh Babu[2]

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Abstract

Split-skin grafts contain the entirety of the epidermis and a variable amount of dermis, depending on the thickness of the harvested graft. The process of skin grafting involves the creation of another wound at the donor site, which has to be managed as the donor-site wound, will be more painful due to exposure of sensory nerve endings and distressing to the patient compared with that of the recipient site.

In spite of various advances in techniques of grafting, management of the donor site is more or less standard. Donor site should also be managed adequately to avoid complications and promote wound healing. Various methods have been used by practitioners for the management of donor site.

Keywords: Donor site, Donor-site management, Dressing, Pirfenidone, Split-skin graft.

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Introduction

Skin grafting is a well-established surgical procedure, where skin or its substitute is used to cover nonhealing ulcers or burns. This method of treatment has been around for centuries and has been used by surgeons to replace damaged or missing skin.[1] There is an increasing number of patients who undergo split-skin grafting due to diabetic ulcers, chronic wounds, burns, or tumor wounds. The management of split-skin graft includes the management of donor site that is often ignored and is more or less standard. Donor site causes more discomfort to the patient and the complication of the donor site might be more troublesome and occurs due to improper care to the donor site.

Donor-site Healing

The donor site of STSGs heals by re-epithelialization, by the migration of the keratinocytes from the edge of the wound, and also from the epithelial remnants from the dermal appendages such as hair follicles, sweat glands, and sebaceous glands. Under normal healing circumstances without complication, the wound heals spontaneously around 7–14 days and lasts up to 21 days, depending upon the age and nutrition of the patient.[2,3]

Donor-site wound heals with two main phases:

Initial wet phase, there is a large number of exudates produced during the first 48–72 hours and then the exudate level significantly reduces and the wound bed becomes dry, dry phase.[2]

Appropriate dressing is necessary for the wound to heal during these two phases to avoid complications. During the wet phase, the dressing should be absorbent and avoid leakage of the exudates and maceration of the surrounding skin. During the dry phase, the absorbent dressing is not ideal as it becomes drier and adheres to the wound, causing pain during removal. Hence, nonadherent dressing should be used.

Donor-site Complication

Wound management should promote healing as quickly as possible to minimize complications and infection. If complicated with infection, the morbidity increases as it further causes damage to the dermal layer, leading to a full-thickness wound.[4]

The most common complications are:

- Exaggerated pain.
- Infection.
- Dyschromia.
- Hypopigmentation.
- Hyperpigmentation.
- Hypertrophic scar.

Dyschromia and hypopigmentation along with itching were found to reduce by 3 months and hyperpigmentation and scarring were seen up to 6 months.[5]

Donor-site Management and Dressings

Successful management of the skin graft includes the successful management of the donor site. It is important as inadequate care leads to infection and scarring. Faster healing of the donor site is necessary for patients with burns requiring a large surface area for grafting and in need of repeated skin harvesting from the same site.[6]

Lars et al. survived the properties of ideal donor-site dressing and the features primarily include absorbency, nonadherent, and antimicrobial activity. There were other properties like easy removal, pain-free dressing change, or no dressing change until the wound heals.[7]

[1,2]Department of General Surgery, Mahatma Gandhi Medical College and Research Institute, Puducherry, India

Corresponding Author: Divya Kumar, Department of General Surgery, Mahatma Gandhi Medical College and Research Institute, Puducherry, India, Phone: +91 9677114234, e-mail: divyakumar.dee@gmail.com

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Various types of dressing are used in the management of the donor site. Both biological and synthetic materials are used.

They are widely classified as OPEN, SEMIOPEN, SEMIOCCLUSIVE, and OCCLUSIVE dressing.

The open method is when the wound is left open to heal by itself. In this method, there is prolonged healing time, the patient is uncomfortable due to pain, and increases the incidence of infection.[8,9]

Semiopen is a type of synthetic material dressing, like fine-mesh gauze impregnated with various materials like bismuth, petroleum jelly, vaseline, scarlet red, and also biobrane.

Semiocclusive dressings are impermeable to bacteria and liquid. Fluid tends to collect beneath the dressing and should be drained, if not, it will promote infection.[8]

Semiocclusive dressings are Tegaderm, Op-site, and Duoderm.

Kaiser et al. compared wound healing with paraffin gauze with semiocclusive modern methods and concluded that semiocclusive methods do not have significant improvement in wound healing or pain and also need a frequent change in dressing, leading to increased cost.[10]

The closed dressing is when the wound is kept dressed until complete healing occurs.

Kilinc et al. studied which dressing type was ideal for split-skin graft donor site, in which they studied the healing time of the wound in open, semiocclusive, and closed dressings. It was found that the patients in the closed-dressing group had early re-epithelialization and painless healing with protection from infection.[9]

Wiechula performed a meta-analysis to determine the best postharvest management of the donor site and the moist dressing had more advantages over that of the nonmoist dressing.[11]

Biological Dressing/Methods

Autograft

Regrafting of the donor site with unused harvest showed significant shortening in the time of epithelization, reduced pain, and hyperplastic scar formation as per Bian et al. study, where he studied three types of dressing for donor area—paraffin gauze, hydrocolloid, and regrafting with thin STSGs. This study revealed a significant reduction in time of re-epithelialization up to 6.5 days compared with 11–13 days in the other two groups.[12] They also found that the regrafting of the donor site is only possible in small wounds. In case of extensive burns where the donor site is limited, the graft is not sufficient to cover the wound.

Allograft

Cadaver skin was used, it was considered to provide temporary wound cover, reduced pain, and controlled fluid loss.

Glycerol-treated cryopreserved allografts are used in extensive scald burns in children, but are very expensive.[8]

Xenograft

Porcine/bovine collagen–elastin prostheses adhere to the wound surface for healing and fall off after epithelialization. It is said to have an antibacterial effect, reduce pain, and fluid loss, but leads to the risk of toxic-substance absorption.[8,13]

Amniotic Membrane

It originates from the ectoderm and is similar to that of human skin, and hence, prevents fluid loss and infection and also reduces pain and improves healing.

Salehi et al. showed that there was a significant difference in the rate of epithelialization and better cooperation of patients for dressings but no difference in the infection rate.[14]

Cultured Keratinocyte Graft

Cultured keratinocytes can be autologous or allogeneic. There is a delay in the time of cultivation of autologous keratinocytes, whereas allogeneic grafts are readily available but have the possibility of disease transmission. The wound heals by the release of cytokines and growth factors.[15,16]

Synthetic Materials

Paraffin Impregnated Gauze

A traditional gauze dressing is most commonly used among developing countries as it is cheap, easily available,[17] and also when impregnated with chlorhexidine, vaseline, and scarlet red. Each type has varied results. These dressings are usually over-padded with gauze rolls and bandage rolls to keep them in place and also to absorb the exudates. This can be heavy that can slip down while walking and tends to get adherent to the wound, leading to trauma to the epithelization.[2]

Polyurethane Transparent Films

Polyurethane films are occlusive dressings that retain moisture, which helps in faster healing, but not suitable for largely exudative wounds, as they lead to exudate leakage, maceration on the epithelial cells, and if the dressing is not changed, it can lead to infection.[2,18–20]

In a comparative study by Dornseifer et al., they demonstrated the superiority of the polyurethane dressing over aquacel.[20] Whereas in another comparative study by Läuchli et al., between calcium alginate and polyurethane film dressing, initially, lower pain scores were seen in film dressing, but there was more dressing change with no significant difference in time to epithelialization and also had problems of leakage.[18]

Hydrocolloid

Moist dressing retains moisture that has shown to improve healing, reduced pain, but in large wounds, exudate leakage can be a problem.

In a multicentric study by Brölmann et al., where he compared alginate, film, gauze, hydrocolloid, hydrofiber, or silicone dressings, he found that in hydrocolloid dressing, complete epithelialization occurred 7 days shorter than the other available methods. Hydrocolloid dressing is also expensive.[21]

Alginate

Alginates are easy to apply and absorb a large number of exudates. It makes it ideal for a large amount of exudating wounds. The gel formed by the alginates tends to dry out, leading to discomfort and pain.[18]

Foam Dressing

They are characterized by their absorptive capacity. But in case of excessive exudative wounds and large wounds, these have to be changed due to soakage and risk of infection. They are available only in standard size and do not comply with various shapes and dimensions of donor sites, nor can they be trimmed to fit.[20]

Pirfenidone

Pirfenidone is a synthetic molecule that acts as a selective cytokine regulator. It is an antioxidant and anti-inflammatory agent

successfully used in pathologies associated with inflammation and oxidative stress.[22] It acts as a modulator for inflammatory cytokines involved in healing like TNF-α, TNF-β, FGF, PDGF, and VEGF, and reduces the expression of TGF-β. This effect of pirfenidone is associated with improved epithelialization as it reduces the inflammatory phase and leads to epithelialization.[23]

Mecott-Rivera et al. worked on the effect of topical pirfenidone on the donor site. To assess epithelialization, biopsies were taken at days 7 and 10 on the pirfenidone group, and day 10 on the clinical photographs. The epithelialization rate was about 98.7% on day 7 and 99.5 on day 10, where in conventional dressing, it was about 83.58% on day 10. This showed significant improvement in epithelialization on topical pirfenidone application when compared with that on the conventional dressing.[24]

Mecott studied the efficacy and safety of systemic pirfenidone in second-degree burns. The study population was 8 patients who were randomized into pirfenidone and regular-dressing groups. Patients treated with pirfenidone showed a statistically significant difference in wound re-epithelialization at day 7 (14.98 ± 13.64 vs 119.27 ± 15.55 μm, $p = 0.029$, 95% confidence interval, 4.14–55.29) and the newly formed epithelium in the pirfenidone group displayed all epidermal layers. Whereas, patients in the usual care group showed a denser fibrotic tissue in their extracellular matrix, and the basal membrane was less evident and hard to identify.[25]

Armendariz-Borunda et al. conducted a clinical trial with topical pirfenidone gel on the treatment of pirfenidone in pathological scarring caused by burns in pediatric patients and concluded that at the end of 6 months, patients treated with topical pirfenidone had a significant reduction in scar when compared with that of pressure therapy. Most of the patients treated with pirfenidone showed a reduction in scar up to 30–45%, whereas pressure therapy showed up to a 16% reduction in the scar.[26]

Although there are multiple above such dressings, there is no single technique that is proven to be advantageous in all aspects. Hence, further studies exploring different types of dressings are required.

Orcid

Divya Kumar https://orcid.org/0000-0002-2535-1873

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