

CASE STUDY

Suprapubic skin as a skin graft donor site for micrograft application in vasculopathies

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Abstract

Background Chronicity of wound in vasculopathies or elderly with atrophic skin pose challenges in clinical management. Harvesting skin grafts from non-hairbearing skin in these patients may lead to the formation of a chronic wound itself.

Methods Under local anaesthesia, skin micrografts were harvested from the suprapubic hairbearing area. Subsequently, harvested skin was applied with fibrin glue and post-operative inspections were performed on days 5, 7, 14

Results Chronic wounds re-epithelised within an average of 2 weeks, donor site re-epithelised within an average of 1.7 weeks

Conclusions The suprapubic skin serves as an effective harvest site for chronic wounds.

Keywords micrograft suprapubic skin, chronic wound, vasculopathy

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Introduction

Poorly healing wounds in patients with vascular disease, including those arising from foot amputations, coronary artery bypass graft donor sites, and minor traumas, pose significant challenges in clinical management.¹⁻⁴ The purpose of this paper is to highlight the utility of suprapubic skin as a donor site owing to its rapidity of healing, ease of harvesting and concealment.^{5,6}

For adequate wound healing to occur there must be restoration of blood supply.^{7,8} Wound bed preparation methods, including surgical debridement, hyperbaric oxygen therapy and negative pressure wound therapy (NPWT), promote angiogenesis, setting the stage for surgical closure by incorporating the TIMERS concept, taking into consideration: Tissue, Inflammation/infection, Moisture imbalance, Epithelial edge advancement, Regeneration, and Social factors.⁹⁻¹²

Skin micrografting is a well-established method of wound closure since micrografts easily expand to cover large areas while minimising donor sites.^{13,14} Successful micrografting hinges on meticulous wound bed preparation, ensuring graft take and eventual chronic wound resolution.¹⁵

Patients and Methods

Over a three-year period from 2021 to 2023, 10 patients with non-healing wounds underwent treatment using micrografts harvested from the suprapubic area, with wound sizes ranging from 115cm² to 2cm², and the median donor site measuring 5cm² (see Table 1). Wound preparation included multiple debridements, followed by the application of NPWT. Eight patients had dermal regeneration templates, from the company Kerecis, applied to cover exposed tendons and deep fascia. Kerecis makes a dermal regeneration template derived from cod skin which promotes tissue regeneration and aids wound healing.^{16,17} In addition three patients underwent hyperbaric oxygen therapy.^{18,19} The average duration of wound preparation ranged from four to eight weeks, and the wounds were micrografted once they displayed stable and healthy granulations.

Wound bed preparation

Initial debridement and desloughing were performed under general anaesthesia. Subsequent minor debridement was conducted in clinics, along with wound inspection to assess for punctate bleeding post-procedure and healthy granulation tissue growth. Healthy granulation tissue is defined as firm vascularised tissue that is not gelatinous or friable and devoid of biofilm.

After debridement the wound dressing chosen depended on the wound condition. For hemostasis, alginate dressing (Kaltostat)²⁰ was used, while medical grade honeys, L-Mesitran and Principelle IF, were used for their bacteriocidal properties.^{21,22} Cellose and collagen dressing (Promogran) was used to promote granulation in punched-out wounds,²³ whereas commercial skin graft (Kerecis) was applied to promote granulation for exposed tendons and ligaments.¹⁷ All dressings were overlaid with either Vacuum-Assisted Closure (VAC) or PICO® dressing for Negative Pressure Wound Therapy (NPWT). Once the wound bed was healthy, the patient proceeded to the micrografting procedure.²⁴

Surgical technique

The operation was performed under local anaesthesia after pubic hair was closely shaved. The donor site was centred on the pubic symphysis and clearly marked to avoid harvesting beyond the hair bearing area. The subcutaneous tissue was further injected with saline to create tumescence. Skin was harvested at a thickness of 9/1000th of an inch (0.2286 mm) using an air dermatome, cutting from caudal to cranial in a safe manner with one hand protecting the genitalia. The donor site was dressed with Kaltostat and foam dressing (Allevyn).²⁵ The skin grafts were laid on a corkboard and cut into micrografts (1x1cm) using either the Zimmer air dermatome blade (manually) or the Meek micrografter.^{13,14} The wound bed was debrided to clear biofilm and create an even wound base. It was then lightly sprayed with fibrin glue (slow-acting Tisseal). The micrografts were then applied and secured with a non-adhesive bolster dressing. Wound inspection, consisting of wound dressing change and checking for graft take, was performed serially on days five, seven and 14 post-operatively.

Illustrative cases

Case 1

A 75-year-old male, with co-morbidities of hypertension, hyperlipidemia and chronic venous insufficiency presented with a full thickness burn wound measuring 21cm by 5.5cm on the shin. The wound exposed deep fascia and paratendinous structures and had to be prepared with debridement, Kerecis application, topical negative pressure dressing and hyperbaric oxygen therapy. Complete granulation of the wound was achieved after eight weeks, and it was successfully covered with micrografts harvested from his hair-bearing suprapubic region (Figure 1.)

Case 2

A 51-year-old male, with multiple co-morbidities including diabetes and chronic kidney disease, underwent coronary artery bypass grafting for ischemic heart disease. He developed non-healing leg wounds at the saphenous vein donor site. He was managed with multiple wound debridement and topical negative pressure dressings for eight weeks owing to slow healing. Subsequently, his wounds were covered with micrografts from the hair-bearing suprapubic region (Figure 2).

Case 3

A 71-year-old male, with peripheral vascular disease presented with a 4cm by 3cm wound over the left foot dorsum exposing extensor tendons following incision and drainage of an abscess. The wound bed was prepared with debridement, Kerecis application and a topical negative pressure dressing. Complete granulation of the wound was achieved after five weeks and it was successfully covered with micrografts harvested from his hair-bearing suprapubic region (Figure 3).

Results

Table 1. Summary table

Summary of results	Median/Range
Age of patients	63.5 (50–84)
Duration of wounds (weeks)	8 (2–16)
Time to ulcer healing (weeks)	3.5 (3–4)
% graft take	95 (85–100)
Donor site healing (weeks)	1.7 (1-2)

Discussion

In normal wound healing there are four main phases – haemostasis, inflammation, proliferation and tissue remodelling resulting in wound resolution.²⁶ During haemostasis, chemokines CCR2 and CX3CR1 attract monocytes and macrophages to the wound site initiating inflammation.²⁷ In well-vascularised tissue, inflammation progresses to tissue proliferation and remodelling to finally complete wound healing.²⁸ However in chronic wounds, the presence of MCP-1 inhibits macrophage maturation from M1 to M2, arresting wounds in the inflammatory phase hindering wound resolution.²⁹⁻³¹ In vasculopathy, there is endothelial dysfunction and accumulation of LDL-oxidated particles which are pro-atherogenic and prolong inflammation, leading to stenosis or occlusion.³²

This study shows that the hair-bearing suprapubic area is a useful donor site for micrografts owing to its rapid healing potential.⁵ In this study, the donor sites re-epithelised in, on average, 1.7 weeks and were free of complications. Rapid healing of donor sites avoids the problems of unstable skin prone to the formation of blisters, infection and scarring.^{4,33} These conditions are commonly seen in vasculopath or elderly due to trophic skin changes resulting in loss of skin appendages.³⁴⁻³⁶

Use of hair-bearing skin for its rapid regenerating properties is well established, with the most common donor site being the scalp.³⁷ Rapid re-epithelialisation occurs as a result of abundant multipotent stem cells in the ‘bulge’ which constitute as skin epithelialisation centres.³⁸ The bulge is a zone of multipotent stem cells surrounding the lower segment of hair follicles. These cells differentiate to form epidermal cells, hair matrix keratinocytes and sebocytes. Cells destined for the epidermis migrate upwards along the germinating layer to populate the interfollicular epidermis and proliferate radially.^{39,40}



Figure 1. Case 1 patient. A: intra-operative post-graft harvesting. B: Donor site one week post-harvesting showing complete re-epithelialisation. C: Recipient site five days post-micrografting, showing adherence. D: Recipient site one week post-micrografting, showing complete epithelisation*.

* Skin epithelisation is defined as the presence of a dry wound site with a sheen.

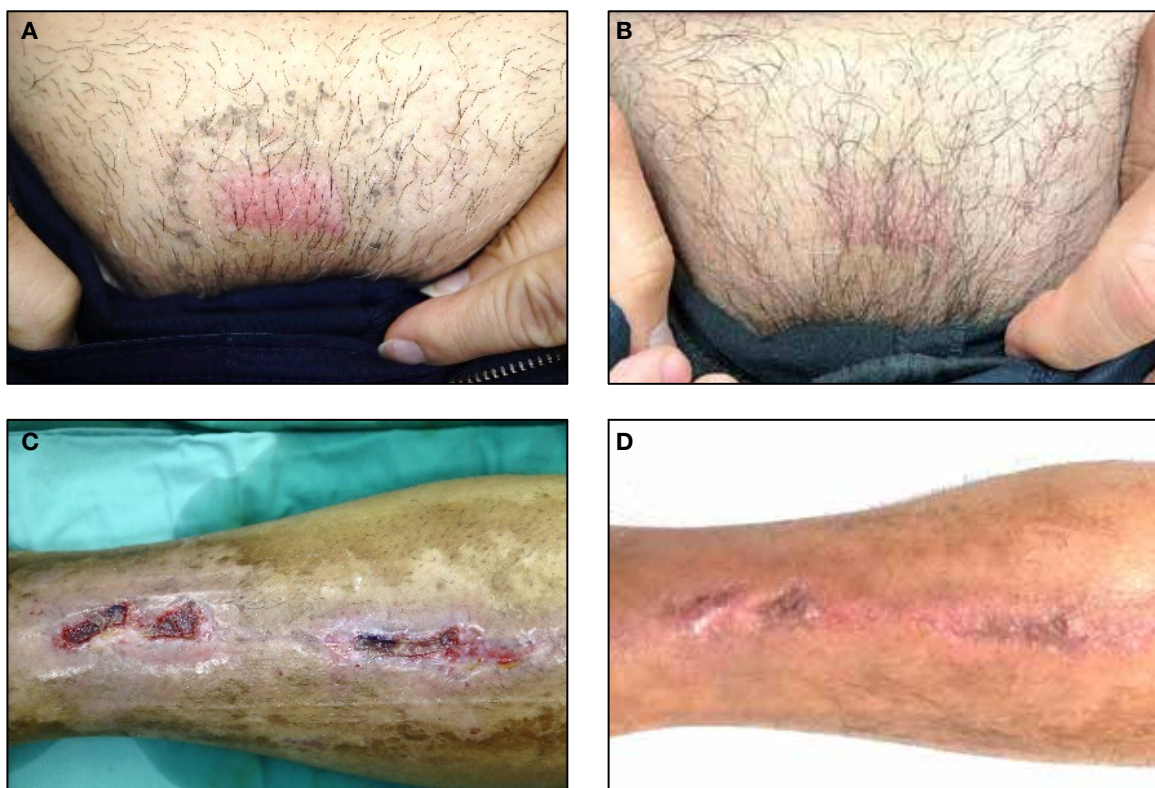


Figure 2. Case 2 patient. A: Donor site one week post-harvesting. B: Donor site two weeks post-harvesting. C: Recipient site with micrograft. D: Recipient site two weeks post-micrografting.

Our patients had non-healing wounds on average for eight weeks, illustrating their poor healing constitution. In such cases, micrografts are a prime treatment for wound healing owing to the delivery of epidermal stem cells to the wound.⁴¹ This was exemplified by our case series where all chronic wounds were completely epithelised two

weeks after skin grafting. Utilisation of micrografts maximised the expansion of skin grafting, so the small suprapubic donor site was not a limitation. Furthermore, this technique could be performed under local anaesthesia making it suitable for patients with multiple co-morbidities. One of the drawbacks of the technique is the psychological sensitivity of the

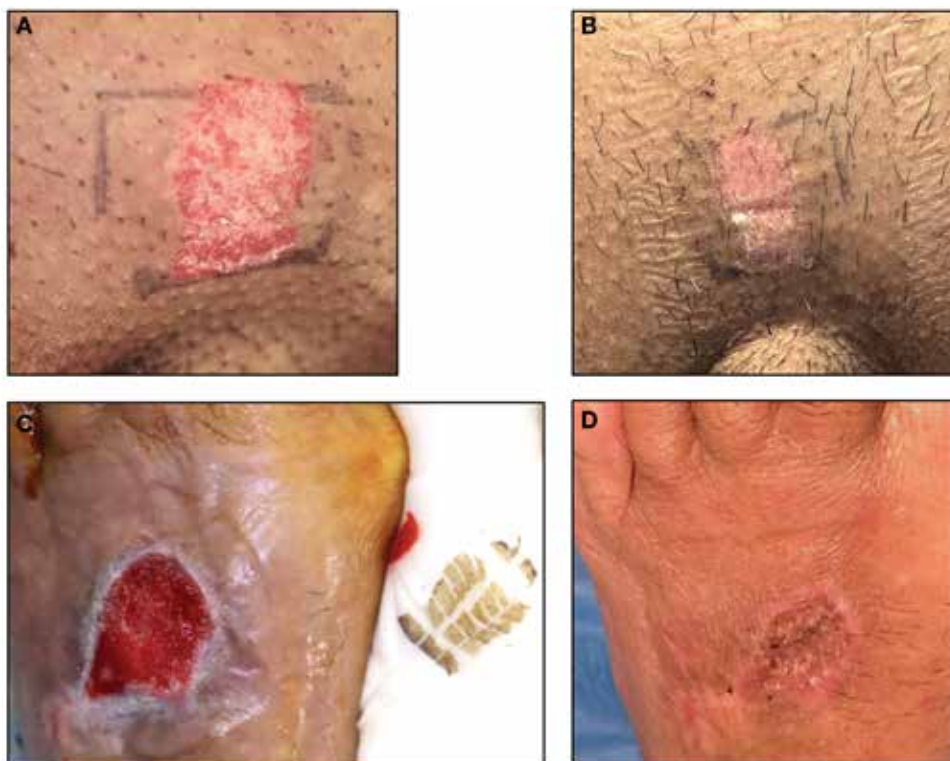


Figure 3. Case 3 Patient. A: Donor site intra-operative post-graft harvesting. B: Donor site one week later. C: Recipient site, intra-operative view, before application of micrografts. D: Recipient site at four weeks

suprapubic area, as patients may be hesitant to having it as a donor site. In addition, post-harvesting wound care required patient to keep the harvest site dressing dry at least for one week until the next dressing change. However, patients usually agreed after an informative discussion.

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Conflict of interest

No conflict of interest.

Ethics statement

This study was performed with and approved by the SingHealth Centralised Institutional Review Board with the approval reference code 2017/2444.

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Author contribution

Sean Yao Zu Kong and Bien-Keem Tan contributed equally to the case series compilation, drafting and revision of manuscript writing.

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