Fat grafting for resurfacing an exposed implant in lower extremity

A case report

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Abstract

Rationale: Although numerous reconstruction protocols have been reported for lower leg trauma, those for distal leg trauma remain few. We present the case of a woman with an implant exposure wound, who was successfully treated through fat grafting, without major flap surgery.

Patient concerns: An 83-year-old woman with an exposed implant in lower extremity received reconstruction surgery once and the surgery failed. She refused additional major surgery and negative pressure wound therapy.

Diagnoses: The diagnosis of a tibia and fibula shaft open fracture (type IIIA) complicated with an exposed implant was made.

Interventions: The procedure was performed by deploying purified and emulsified fat with a Micro-Autologous Fat Transplantation gun. The required liposapirate amount was grossly estimated using a standard formula: 0.5 cc of a liposapirate per square centimeter of wound. We prepared the lipoasapirate simply through centrifugation followed by physical emulsification. The endpoint of fat grafting was when liposapirate began to flow out of the wound. The initial dressing after the procedure included the topical usage of biomycin ointment with AQUACEL Foam (Convatec Inc., NC, USA) coverage, which was later changed to INTRASITE gel (Smith & Nephew, London, UK) with a gauze dressing for 4 weeks. After 4 weeks, dressing components were changed to Mepilex (Mölnlycke Health Care, Gothenburg, Sweden) alone.

Outcomes: The wound healed completely without requiring major flap surgery by 18 weeks after surgery.

Lessons: Fat grafting is one kind of cell therapy and potentially has regenerative effects during wound healing. Fat grafting is critical in the healing processes of complicated wounds and might be considered a step in reconstruction surgery.

Abbreviations: ASC = adipose-derived stem cell, e-SVF = enhanced stromal vascular fraction, NPWT = negative pressure wound therapy, PRP = platelet-rich plasma, SVF = stromal vascular fraction.

Keywords: fat, implant exposure, lower limb, trauma

1. Introduction

Motorbike accidents are a common trauma event in Taiwan.[1] High-energy trauma occurs after severe crushing of soft tissue and comminuted bone fracture. The trauma zone is wide in this type of injury and aggressive management of the bony fracture usually increases the risk of implant exposure. Traditionally, flap coverage is the gold standard to reconstruct this defect.[2,3] However, major flap surgery is unsuitable for older adults with multiple underlying diseases, particularly peripheral vascular and renal diseases.[4,5] In such cases, negative pressure wound therapy (NPWT) and other modern dressing choices may be beneficial; however, the use of some of them remains controversial.[6]

Autologous fat transfer has been applied in the clinical field not only for volume expansion[7] but also for treating wounds, such as burns, radiation ulcers, and diabetic foot ulcers[8–10] and to relieve burn-induced neuropathic pain in an animal model.[11]

Here, we present the case of an implant exposure patient who was successfully treated with fat grafting without major flap surgery.

2. Case report

Our patient was an 83-year-old woman with a history of hypertension and a tibia and fibula shaft open fracture (type IIIA) following a motorbike accident (Fig. 1A). The fracture had been managed through open reduction and internal fixation. However, ongoing wound margin tissue necrosis lead to implant exposure during her outpatient follow-up. Consequently, a second surgery was arranged. The transposition flap was harvested to cover the exposed plate, and the donor defect.
was covered using a skin graft. However, this surgery failed to cover the exposed implant. Progressive ischemic change of the distal part of the flap resulted in wound dehiscence followed by plate exposure (Fig. 2A). Because of this complication, we consulted a plastic surgeon for a reconstruction plan 6 weeks after the initial injury.

On evaluation, an implant exposure wound (size: 5 cm × 2 cm) was noted over the distal leg, with unstable periwound soft tissue conditions and distal vascularity. The potential applicability of free flap surgery to cover the exposed plate was discussed with the patient and her family; however, they refused additional major surgery. NPWT was suggested, but her family rejected this because it is uneconomical. The patient was then transferred to the outpatient department for the intractable wound.

During follow-up, her wound was in the proliferation phase, and it was too early to remove the internal fixation plates. Under these conditions, fat grafting was suggested as an alternative (Fig. 2B). Informed consent of the patient was obtained, and fat grafting was performed 2 weeks after discharge.

3. Operation technique

Under local anesthesia, fat was harvested over the lower abdomen after tumescent solution infiltration. A low-negative pressure liposuction procedure was performed using a standard liposuction device. Fat was harvested using a multiport 3-mm cannula with sharp side hole of 1-mm diameter. Lipoaspirates were processed and purified through centrifugation at 600 rpm for 3 minutes. The oily and aqueous fractions were discarded; only purified fat was collected and then emulsified by shifting the fat between two 10-cc syringes connected with a female-to-female luer lock connector. The purified and emulsified fat was then transferred into a 1-cc luer slip syringe and loaded onto a Micro-Autologous Fat Transplantation gun (Dermato Plastica Beauty Co, Ltd, Kaohsiung, Taiwan) connected to a 22-gauge sharp cannula. This device was set by deploying a fat parcel of 1/150 mL with each trigger. A wide distribution field was applied. The required lipoaspirate amount was grossly estimated using a standard formula: 0.5 cc of a lipoaspirate per square centimeter of wound. Finally, a total of 16 mL of the lipoaspirate was grafted. Because tissues were atrophic and scarred, the approximate amount of the lipoaspirate that may pour out during administration was also considered in the injection amount. The

Figure 1. (A) The radiograph of left tibia and fibula shaft open fracture (type IIIA). (B) A follow-up radiograph after plate exposed wound healing, showing fair alignment.

Figure 2. (A) Progressive ischemic change in the flap and partial skin graft failure were noted during admission. (B) Wound dehiscence with an implant exposure area of up to 5 cm × 2 cm was noted before fat grafting. No sign of acute infection was noted.
The initial dressing after the procedure included the topical usage of bacitracin ointment with AQUACEL Foam (Convatec Inc., NC) coverage, which was later changed to INTRASITE gel (Smith & Nephew, London, UK) with a gauze dressing for 4 weeks (Fig. 3A). After 4 weeks, dressing components were changed to Mepilex ( Mölnlycke Health Care, Gothenburg, Sweden) alone. A second fat grafting procedure was not indicated because healthy granulation tissue was noted around the wound edge, which progressively wrapped the implant. An episode of biofilm coating occurred 16 weeks after surgery; this was managed using Prontosan Wound Irrigation Solution and Gel (B. Braun Medical Ltd, Sheffield, UK; Fig. 3B). The wound healed completely without requiring major flap surgery by 18 weeks after surgery (Fig. 3C). During the whole clinical course, the patient received fat grafting once and had 10 outpatient visits. A follow-up lower limb radiograph after plate exposed wound healing, showing fair bone and plate (Fig. 1A). She was satisfied with the results.

4. Discussion

Numerous reconstruction protocols have been reported for lower leg trauma, but those for distal leg trauma are lacking. Pedicled perforator flaps and free flaps are the standard reconstruction plans. However, in our patient, pedicled perforator flaps were unsuitable because she demonstrated an extensive trauma zone.

The endpoint of fat grafting was when lipoaspirate began to flow out of the wound.

Cell therapy, including the use of stromal vascular fractions (SVFs), platelet-rich plasma (PRP), and adipose-derived stem cells (ASCs), potentially retains graft volumes and has regenerative effects during wound healing. 

Several theories have been proposed to explain how a lipoaspirate participates in the wound healing mechanism. The paraendocrine and proangiogenesis effects of transplanted adipose tissue on the surrounding tissue may clarify how lipoaspirates heal wounds and can even treat fibrotic tissue.

The ultrastructural analysis results of Rigotti et al demonstrated that fibrotic tissue after a fat grafting procedure appeared well hydrated and with large extracellular spaces in the early stages and that the tissue then matured and appeared similar to normal mature adipose tissue; this process is called mesenchymalization. We applied this concept in this carefully selected patient to manage the tissue defect and fibrosis after wound dehiscence.

Various fat grafting preparation methods and cell therapy types have been reported and discussed. Several clinical trials on ASCs and SVFs have been documented. The clinical applications of fat grafting are mainly in the field of soft-tissue augmentation, improving tissue perfusion and wound healing.

Cervelli et al demonstrated the use of fat derivatives and PRP for treating traumatic ulcers on the lower limbs; the authors evaluated the effects of enhanced SVF (e-SVF) use and fat grafting with PRP. The results showed that wounds treated with e-SVF healed more favorably than those wounds covered with a hyaluronic acid sheet. Wounds treated using fat grafting with PRP also significantly improved reepithelialization compared with those treated with only PRP.

The relation between wound healing efficiency and the frequency of lipoaspirate injection is not clearly studied because no standardized lipoaspirate could be provided. Components of lipoaspirates in different individuals vary. In the study of Cervelli et al, patients treated once with PRP and fat grafting healed 97.8% of the difficult wounds in less than 10 weeks. Stasch et al demonstrated that 88% of difficult wounds healed completely after 1 session of lipotransfer in around 2 months. In 1 special case who had chronic scarring following a compound fracture and repeated infections, second session of lipotransfer was indicated on day 30 after the initial procedure and the wound healed on day 107. In this case series, most wounds had a reduction of wound size by 50% in 4 weeks after intervention. Although further large-scale clinical studies are needed to answer the relation between wound healing efficiency and the frequency of lipoaspirate injection, the second session of lipotransfer may be indicated after clinical observation of wound size reduction percentage in 4 weeks.

In Taiwan, the clinical application of cultured or expanded cell therapy is not yet legally approved. Therefore, we prepared the lipoaspirate through centrifugation followed by physical emulsification in this case. Although the dosage required for this therapy is not yet standardized, our results indicate the benefits of this simple procedure to patients with wounds similar to our case.

To the best of our knowledge, this is the first case presenting a satisfactory result for resurfacing an exposed plate with fat grafting as an alternative method for secondary intention of wound healing. However, the indications and actual mechanisms of fat grafting in reconstructive surgery are still under investigation. The standardization of therapeutic protocols is warranted before their wide clinical application in cases similar to ours. Moreover, we could not compare the effects of our lipoaspirates injection procedure alone with those of the
procedure combined with various dressing types; therefore, additional case–control studies are required for these comparisons.

5. Conclusion

Lipoaspirates injection is helpful in wound healing in this selective case; fat grafting plays a crucial role in the healing process of complicated wounds and might be considered a step in reconstructive surgery.

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