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Role of Autologous Lipoaspirate Therapy (ALT) in Wound Healing

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Abstract

Aim: To study the role of Autologous LipoapsirateTherapy (ALA) in management of chronic non healing wounds. **Methods:** A retrospective analysis of 8 cases with 10 chronic non healing wounds of different aetiologies where autologous lipoapsirate therapy was used. **Results:** Out of 8 cases with 10 wounds, 4 wounds healed with autologous lipoaspirate therapy (ALA) alone. Three wounds healed by ALA and skin graft and 3 healed by ALA and flap cover. **Conclusion:** In chronic non healing wounds, ALA therapy accelerates the process of wound healing by secondary intention and hastens the wound bed preparation for cover by skin graft/flap.

Keywords: Autologous lipoaspirate; chronic non healing wounds

Introduction

Optimum healing of a cutaneous wound requires a well-orchestrated integration of the complex biological and molecular events of cell migration and proliferation and extracellular matrix (ECM) deposition, angiogenesis, and remodeling.[1] Normal wound healing is a dynamic and complex process involving coordinated interactions between diverse immunological and biological systems. It involves a cascade of carefully and precisely regulated steps and events that correlate with the appearance of various cell types in the wound bed throughout the distinct phases of the healing process.[2] The use of stem cells in cell therapy is being studied in several areas of medicine. Adipose tissue appears to be a remarkable source of mesenchymal stem cells (MSC). Since adult stem cells (ASC) are easily isolated from a section of whole fat (biopsy) or lipoaspirate, a relatively less aggressive and painful procedure is necessaryto obtain the cells.[3] Here we discuss or experience of using lipoaspirate in expediting wound healing in cases of chronic non healing ulcers.

Materials and Methods

This study is a retrospective analysis of cases where lipoapsirate was performed during July 2012 to July 2014 in a tertiary care hospital in India. Eight cases (10 wounds) matching the inclusion criteria are reported here.The patients were divided into three groups.

Group 1 - patients who healed completely by secondary intention with autologous lipoapsirate alone. (GROUP 1 – ALA ONLY)

Group 2 – patients who received autologous lipoapsirate and the wounds covered with skin graft (SSG) / flap (GROUP 2 – ALA + SSG/ FLAP)

The demographic data, site, size, aetiology of the wound and the duration of wound healing were noted. All cases were admitted and treated in the Department of Plastic Surgery. We used the technique described by Rigottiet al.[4] for the preparation of Autologous lipoapsirate.

1. Informed written consent is taken
2. The site for fat harvesting (lower abdomen, flanks, thighs, gluteal region) is cleaned and draped.

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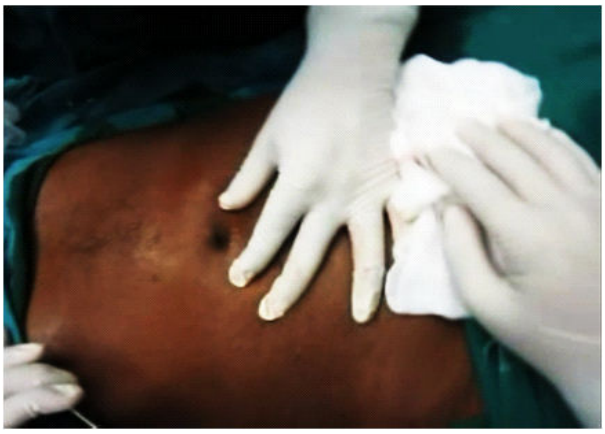

Fig.1: Site of harvest

3. Infiltrate the site with tumescent technique (100 ml of saline with 75 mg levobupivacaine, 40 mg mepivacaine and 0.5 ml of 1in 1000 adrenaline).
4. Connect a blunt 2-3 mm cannula to a syringe.
5. Make a small incision over the donor site.

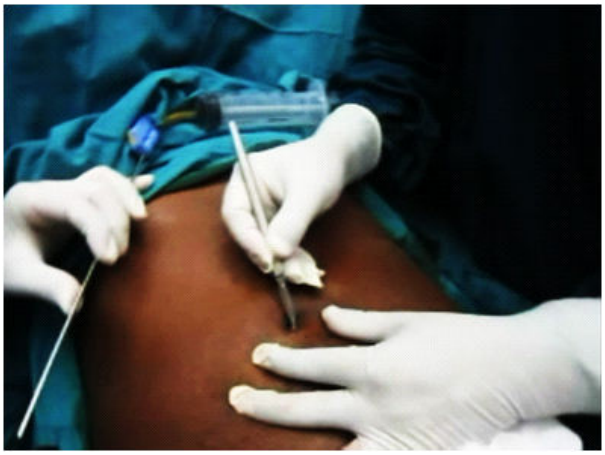

Fig. 2: Incision

6. Insert the cannula into subcutaneous tissue and give negative pressure by pulling the plunger of the syringe. Fat is harvested using Coleman microcannula technique.
7. Obtain approximately 10 ml of adipose tissue sample.
8. Transfer the lipoapsirate into the centrifugation tubes. Centrifuge at 3000 rpm for 3 minutes.
9. After centrigugation 3 layers are formed

- Top layer composed of oil from ruptured parcels of fat.
- Middle layer of compact adipose adipose tissue and cells.

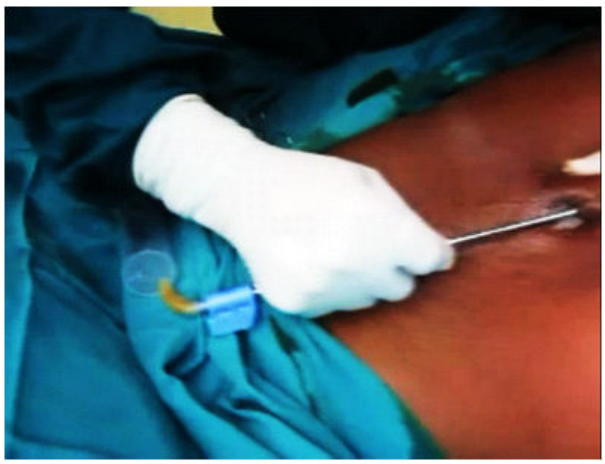

Fig. 3: Fat harvesting

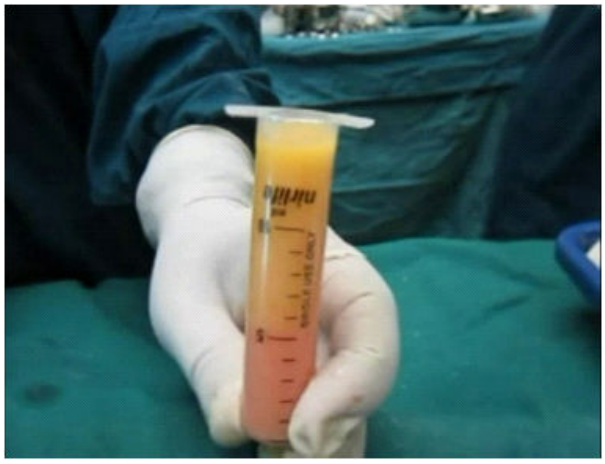

Fig. 4: Sample obtained

Fig. 5: Centrifugation of sample

- Bottom layer of blood and substances used for infiltration

10. Discard the top and bottom layer. The middle layer is used for lipoapsirate therapy.

11. The harvested lipoapsirate can be smeared over the wound and injected subcutaneously into the wound edges.

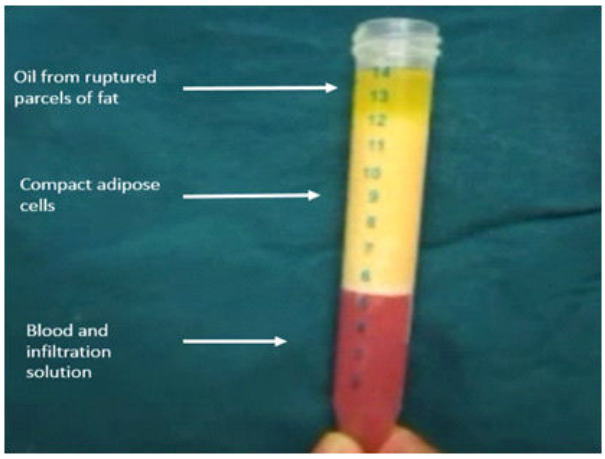

Fig. 6: After centrifugation sample

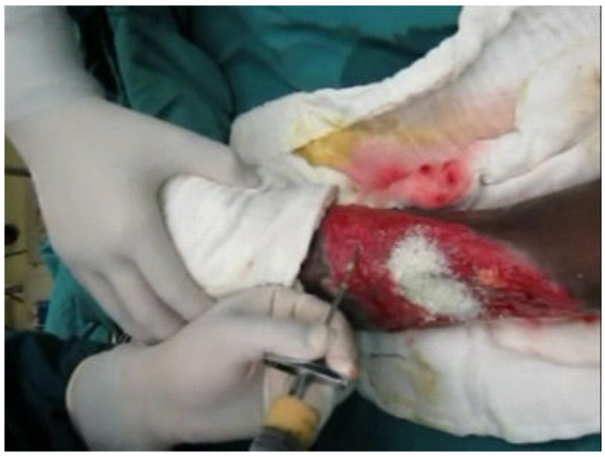

Fig. 7: Autologous Lipoaspirate injection into wound edges

Results

In our study cohort (n=8 patients, 10 wounds) age of the patients ranged from 23 years to 60 years (mean age 39.37 years). Males were more than females (with ratio 3:1). The most common site of chronic wound was lower limb (leg & foot). In Group-1(3 patients, 4 wounds), all wounds healed by ALA alone (Figure 8, 9, 10). In Group-2 (5 patients, 6 wounds), 3 wounds healed by ALA with Skin Graft (Figure 11,12,13) and 3 wounds healed by ALA with flap cover (Figure 14,15,16).. In Group-1 (treated by ALA only), mean size of the wounds was 81.25 square cm (range 9-150 square cm). In Group -2 (treated by APRP + ALA/ Flap), mean size of the wounds was 47.33 square cm (range 12-105 square cm). Mean total duration of healing in Group-1 was 12.6 weeks (range 8-16 weeks) and in Group-2 mean duration of healing was 11.4 weeks (range 6-14 weeks) (Table 1).

GROUP 1 – ONLY ALA

Figure8, Figure 9, Figure 10.

GROUP 2 -ALA + SSG

Figure 11, Figure 12, Figure 13.

GROUP 2 – ALA + FLAP

Figure 14,Figure 15, Figure 16.

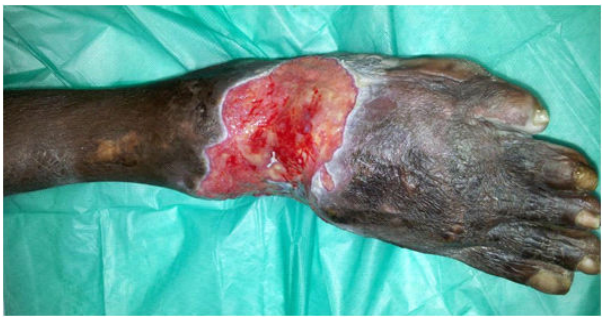

Fig. 8: Wound at admission

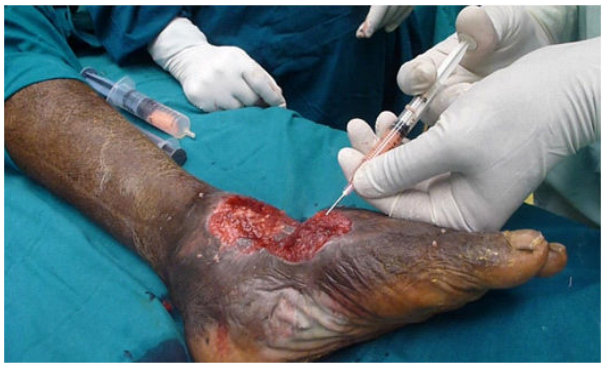

Fig. 9: Demonstration of ALA injection

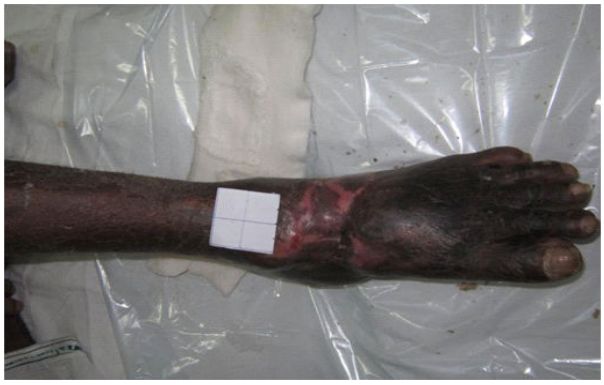

Fig. 10: After healing of the wound

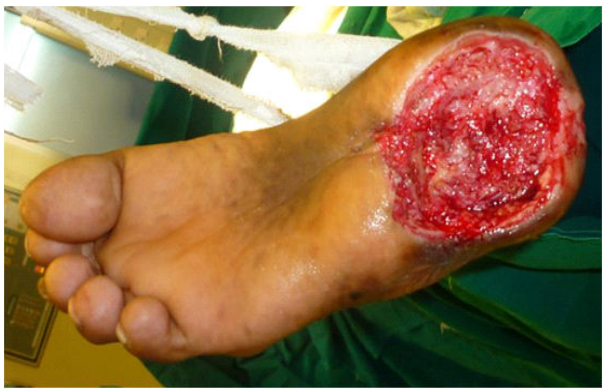

Fig. 11: Wound at admission

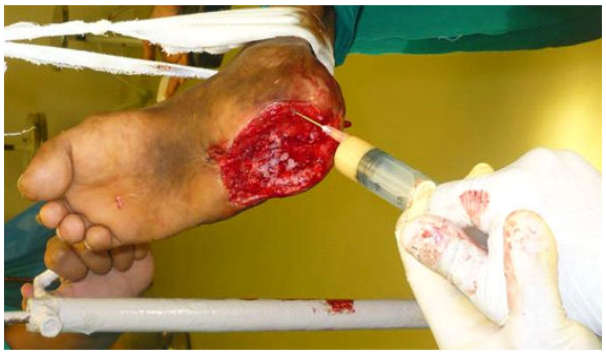

Fig. 12: Demaonstration of ALA injection

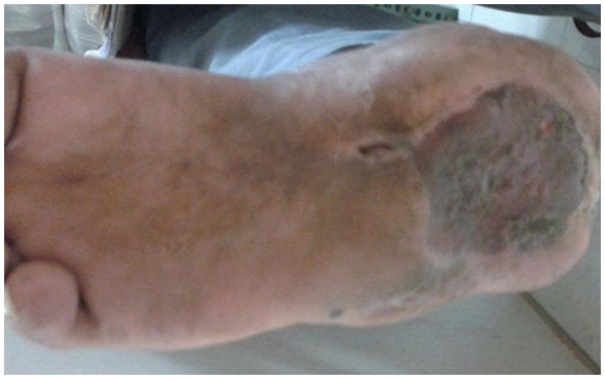

Fig. 13: Demonstration of healing of the wound after SSG

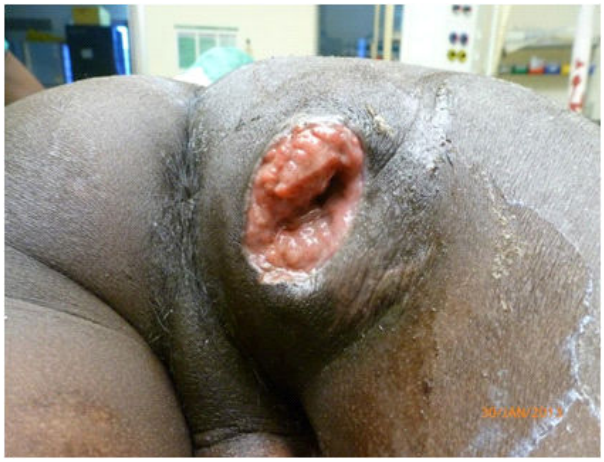

Fig. 14: Wound at admission

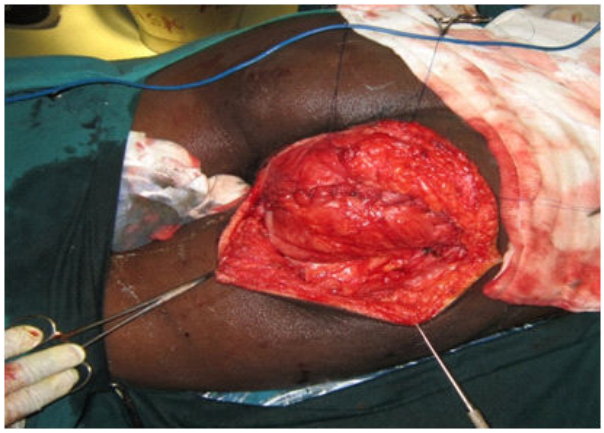

Fig. 15: Demonstration of flap

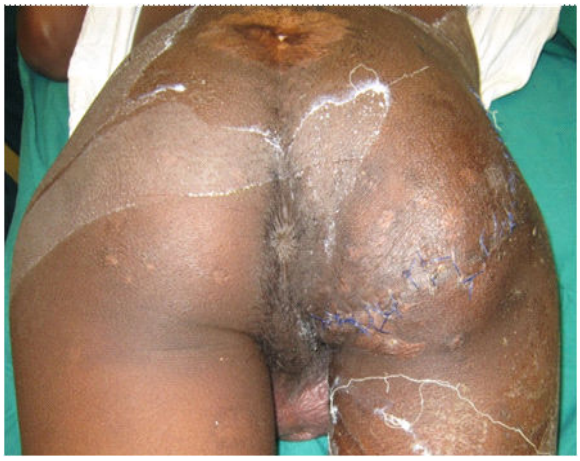

Fig. 16: Demonstration of healing of the wound after flap

Discussion

The normal pace of wound healing and epithelialization is at the rate of 1mm/day. Optimum recovery requires the wound bed and the patient to be fit. To assist with implementing the concept of wound bed preparation, the TIME acronym was developed in 2002 by a group of wound care experts, as a practical guide for use when managing patients with wounds[5]. The TIME table summarizes the four main components of wound bed preparation:

1.Tissue management

2.Control of infection and inflammation

3.Moisture imbalance

4.Advancement of the epithelial edge of the wound.

Table 1

Sl.No	Age	Gender	Diagnosis And Site	Size of Wound	Method of Healing		Healing Duration
					Group 1 (Ala Only)	Group 2 (Ala +Ssg/Flap)	
1	36	Male	Post Traumatic Raw Area Left Foot With Osteomyeltis	15x10cm	✓		14 Weeks
2	47	Female	Right Diabetic Foot	5x4cm And 6x2cm		✓ (Flap)	14 Weeks
3	42	Male	Post Traumatic Raw Area Right Heel	7x6cm		✓ (Ssg)	6weeks
4	31	Female	Non Healing Ulcer Left Ankle With Sle, Dm, Ht Varicise Veins	15x7cm		✓ (Ssg)	11 Weeks
5	60	Male	Post Traumatic Raw Area Right Leg	4x4cm And 3x3 Cm	✓		8 Weeks
6	24	Male	Grade 4 Right Ischial Pressure Sore With Paraplegia	5x5cm		✓ (Flap)	14weeks
7	23	Male	Post Blunt Trauma Abdomen Grade 4 Sacral Pressure Sore With Enterocutaneous Fistula	15x10cm	✓		16 Weeks
8	52	Male	Paraplegia With Grade 4 Sacral Pressure Sore	10x8cm		✓ (Ssg)	12 Weeks

The advanced wound healing therapies aim to hasten the process of wound healing by expediting the advancement of epithelial edge of the wound. Many growth factors have been used to advance the epithelialisation. But the paradigm of wound healing is changing from repair of the tissue towards the regeneration of the tissue. The pre requisite for regeneration of tissue is the presence of stem cells in the wound environment.

Stem cell therapy is clinically applied as a safe and effective method for repair of several types of tissue damage.[6,7,8] ADSCs and their secretory factors have been investigated as a substi-tute for BMSCs, which offers a potential solution to skin repair and regeneration.[9,10] Adult stem cells (ASC) are classified into hematopoetic stem cells (HSC) and mesenchymal stem cells(MSC).[11]

MSCs were first characterized in bone marrow, but many studies have reported the existence of MSCs in the connective tissue of several organs.[12] The most abundant and accessible source of adult stem cells is adipose tissue and MSCs have been obtained by lipo-suction of human adipose tissue.[13] The yield of MSCs from adipose tissue is approximately 40-fold greater than that from bone marrow.[14] ADSCs may exert their beneficial effects via complex paracrine mechanisms in addition to a building-block function. The wound-healing effect of ADSCs is mediated by secretory factors and the function is enhanced by hypoxia.

Given their convenient isolation compared with BMSCs and extensive proliferative capacities *ex vivo*, ADSCs hold great promise for use in wound repair and regenera-tion.[15] Recently, evidence has accumulated that demon-strates the wound-healing effects of ADSCs[16] ADSCs are physiologically located beneath dermal fibro-blasts, and they may interact with them. However, ADSCs and their secretory factors may reach the epidermis in the case of skin damage. Hypoxia amplifies the paracrine effects of MSCs by enhancing the secretion of certain growth factors.[17]

In our study we used lipoaspirate, harvested as per the technique described by Rigottiet al.[4] In patients who are not fit for surgery/unwilling for surgery, we used ALA therapy as an adjunct to regular management of the wound. In this group of patients, ALA therapy accelerated wound healing and wound bed preparation for cover by SSG/flap. Due to small sample size statistical analysis could not be done. A randomised control study with adequate sample size with wounds of different aetiology is desirable to substantiate the results.

Conclusion

In chronic non healing wounds, ALA therapy accelerates the process of wound healing by secondary intention and hastens the wound bed preparation for cover by skin graft/flap.

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