International Surgery Journal
Castaneda RB et al. Int Surg J. 2026 Jul;13(7):xxx-xxx
https://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20261865

Case Report

Autologous abdominal fat graft transposition for ischemic foot lesion with tendon exposure: a case report and literature review

Ricardo Burciaga Castañeda[1]*, Ana Sofia Enriquez Arreola[2], Miguel Angel Burciaga Castañeda[3], Jose Humberto López Chávez[4], Maria Del Socorro Nava[5], Jaime Sergio Rocha Chong[4], Roberto David Chavez[6], Gabriela Etelvina Talavera Ramos[7]

[1]Hospital ISSSTE Gómez Palacio, Dgo, Mexico
[2]Universidad Juárez del Estado de Durango, Gómez Palacio, Durango, Mexico
[3]Hospital General 450, Durango, Mexico
[4]Hospital ISSSTE Gómez Palacio, Durango, Mexico
[5]Hospital Clínico Quirúrgico Hermanos Ameijeiras, Mexico
[6]Universidad Autonoma de Coahuila, Torreon, Mexico
[7]Hospital Dr. Santiago Ramón y Cajal Dgo, Dgo, Mexico

Received: 25 May 2026
Accepted: 09 June 2026

***Correspondence:**
Dr. Ricardo Burciaga Castaneda,
E-mail: dr.bresssurgeon@gmail.com

ABSTRACT

The management of complex wounds such as diabetic foot ulcers, chronic arterial insufficiency lesions, and sacral pressure ulcers is on the rise in recent years due to the chronic nature of these wounds, the potential to become infected, and the difficulty in healing. Microsurgical reconstruction and local flaps are options but may not be possible in patients with significant vascular compromise. The autologous fat grafting has evolved from a simple volume filler to a potent biological modulator because it contains adipose-derived stem cells (ASCs) and growth factors. We discuss the physiologic mechanics of fat grafting and its advantages and disadvantages in the context of complex ischemic lesions.

Keywords: Reconstructive surgery, Autologous fat grafting, Tendon exposure, Graft survival

INTRODUCTION

Autologous fat grafting, first reported in the 19th century, has quickly evolved into one of the most important techniques in the field of reconstructive and aesthetic surgery.[1] The most important advantages are they are biocompatible, cheap, readily available, and have low immunogenicity. Millions of people throughout the world suffer from complicated wounds resulting from vascular, neuropathy, or pressure problems. Treatment consists, in most of the cases, of debridement, compression therapy, advanced dressings, and often reconstructive surgery with flaps. However, not all patients can be submitted to major surgery because of co-morbidities, risk of anesthesia, or limited vascular access. In this context autologous fat grafting has increasingly been used as an important alternative or adjunct.[2] It can induce local vascularization, reduce inflammation, and stimulate skin regeneration; thus, it has the potential to be an effective technique for the management of complex wounds.

History

The first attempt to transplant autologous adipose tissue was undertaken by Meulen in 1889. The work was grafting omental adipose tissue to the liver and diaphragm in the treatment of a diaphragmatic hernia. A significant transfer of the adipose tissue was described by Neuber et al in 1893.[3] Adipose tissue of the forearm was used to increase volume and correct irregularities of the face due to the scar with good aesthetic results. Czerny et al used the patient's own fat tissue from the back to reconstruct breasts in 1985. Brunning et al performed the first fat transplant in 1911 with a catheter and syringe. He was the first to use an autologous adipose graft in the subcutaneous area to improve aesthetic results in rhinoplasty. It was he who first noted that the reabsorption of transplanted fat led to transient aesthetic results. Miller and colleagues further developed the injection method using a metal tube to transfer autologous fat. This method predates the techniques we use today. In 1975, the Fischer father-and-son team made a big step forward with the invention of the modern liposuction technique with metal cannulas.[4] These cosmetic surgeons had, three decades earlier, made a blunt hollow cannula connected to a suction device to remove fat through many entry points.

The technique was developed by Illouz et al using a suction machine with Fischer cannulas. This procedure, performed thirty years ago, was the genesis of modern liposuction technology. However, the modern evolution of liposuction was made in 1990 when Coleman et al described a new method of adipose tissue extraction that reduces the damage to adipocytes.[5] The method was later refined by incorporating Dr. Klein's 1993 recommendation that the harvest site be treated with tumescent solution.

Harvesting, liposuction technique and proccesing

Other methods used to collect donor adipose tissue prior to transfer include vacuum or syringe aspiration and surgical excision. The deep layer of the subcutaneous fat has been shown to contain the most advanced adipocytes and efficiently remove detritus, erythrocytes, and dermal appendages, making it the best harvesting site.[6] Donor tissue is commonly taken from the abdomen, buttocks, and posterior thigh. No difference was observed in harvest weight, volume maintenance, or cell viability in studies. Fat can be removed with dry, wet, or tumescent techniques. The dry technique does not require injection of any substance at the donor site. Typically this procedure is done under general anesthesia because the donor site is not infiltrated with local anesthetic. In wet procedures, the volume of the injectant is equal to the volume of the adipose tissue. However, any ratio over one is considered extremely wet, with the general ratio of injectant to fat harvest volume being three to one in super wet procedures. The most commonly used technique is the tumescent technique.[7] This technique uses a large volume of subcutaneous infusion to minimize blood loss, anesthetize the area, and allow for better removal of fat while minimizing tissue damage (Klein). This procedure is mainly used for liposuction and large-volume grafting, but it is capable of harvesting any amount of fat. For low-volume grafting, the Coleman technique for cannula harvesting is often used, first described in the late 20th century and improved in the early 21st century, providing better adipocyte viability and graft retention with less stress. Studies have shown that high negative pressure vacuum liposuction can traumatize and destroy up to 90% of adipocytes.[8] It is generally agreed that the harvested adipose tissue must be large enough to preserve the natural architecture of the adipocytes and their spatial relationship to the stromal elements, but small enough to allow diffusion of nutrients through the graft.

The survival of the fat transplant depends on the survival of the most mature adipocytes and mesenchymal stem cells of the stromal component. Postharvest processing removes unwanted contaminants such as free oil from traumatic rupture of mature adipocytes, cellular debris, nonviable components such as erythrocytes or other hematogenous cells, and inflammatory substrates and maximizes substrate concentration. Contamination can cause inflammation of the recipient site, thus jeopardizing the survival of the graft. It has been shown that erythrocytes and other heterogeneous components can accelerate breakdown of grafted fat.[9] This is offset by limiting their harvest by tumescent techniques and post-harvest processing that may enhance retention after grafting. Sedimentation is the least traumatic postharvest technique and gives the maximum viable adipocytes. This can be done by gravity separation or decantation, where the lipoaspirate is allowed to settle into layers of varying densities with time, and then the adipose layer is collected for injection.[10] However, this method maximizes the mesenchymal fat components and therefore has the minimum number of stromal components and stem cells. Filtration methods, however, remove most of the contaminants and inflammatory components and keep alive the mature viable adipocytes and the adipose-derived mesenchymal stem cells of the fat stroma. This is a simple and convenient technique for lower-volume fat grafts. It can cause fat dehydration and decreased graft survival but has a limited ability to remove free cellular components and unwanted debris. The most common and feasible postharvest processing method is centrifugation.[11] The standard for a lot. Actually, all the harvesting techniques described here are really much the same. Centrifugation is the most accurate method for separating graft components and provides a much more targeted approach to graft processing. Centrifugation separates components by density, with layers that are easily separated and transferred.

Coleman was the first to describe the process of centrifugation during the processing of lipoaspirate after harvest. As previously mentioned, lipoaspirate is placed in 10-mL Luer-Lok syringes with blunt 17-gauge cannulas and centrifuged at 3000 rpm for three minutes by the standard Coleman method.[12]

The blood and tumescent aqueous solution fraction at the bottom of the syringe is drained. After pouring off the oil from the top layer and wicking with a cotton pad for a few minutes, only the mesenchymal component remains. This has been well scrubbed.

CASE REPORT

A 72-year-old female with a history of type 2 diabetes mellitus and peripheral artery disease was referred to the General Surgery service for an ischemic lesion on the dorsum of the right foot with exposure of the extensor tendons. On physical examination, a defect of approximately 20×15 cm with devitalized tissue, inadequate soft tissue coverage, and signs of distal hypoperfusion was noted. The ankle-brachial index was 0.5. Free flap surgery was not possible in the patient due to gross vascular impairment. Decision was made to go ahead with autologous fat grafting. Then, the adipose graft was injected and dispersed as microdeposits in both deep and superficial layers, covering the tendon exposure area, to create a biologically conducive environment for tissue regeneration. After 8 weeks, once good granulation tissue was present and the local wound bed had improved, a split-thickness skin graft was performed for final closure of the defect.

Figure 1: Right foot exhibiting necrotic tissue.

Figure 2: Right foot post-surgical debridement.

Figure 3: Right foot with fat graft deposits 1 week with granulation tissue.

Figure 4: Right foot posterior view.

Figure 4: Right foot after split-thickness skin graft.

DISCUSSION

The application of autologous fat grafting is widely used in clinical practice, especially in posttraumatic, iatrogenic, and congenital defects. It is also used in aesthetic treatments for modeling and filling wrinkles and lips, as well as raising body parts like breasts. The regenerative properties of autologous fat, biocompatibility, safety, and efficacy as a filler material have led to its widespread use. In addition, autologous fat is used for the treatment of lesions difficult to heal for different causes.[13] Furthermore, the addition of autologous fat grafts to scars improves the quality of the epidermis of the recipient site. Another advantage is that the procedure is simple, has few side effects, and is minimally invasive. Autologous fat grafting has become a very useful adjunct in reconstructive surgery in the management of non-healing chronic wounds such as diabetic foot ulcers, sacral pressure sores, and arterial insufficiency ulcers. This effect is achieved by exploiting the regenerative potential of ASCs and stromal vascular fraction, which are both secreting angiogenic factors. These factors include vascular endothelial growth factor (VEGF), hepatocyte growth factor (HGF), and fibroblast growth factor (FGF).[14] These mechanisms result in enhanced neovascularization, improved local tissue oxygenation, reduced chronic inflammation through immunomodulatory macrophage polarization, and enhanced extracellular matrix remodeling. Ultimately, this accelerates the wound closure process and enhances the quality of granulation tissue.[15] The main advantages of this method are the autologous nature of the treatment (no risk of immunogenicity or disease transmission), the minimal donor site morbidity, the relatively low cost, and the possibility of repeating the procedure in stages. Chronic wounds that can be treated with fat grafting include full-thickness ulcers, clean stage III or IV pressure ulcers (post-surgical debridement); and ischemic ulcers in patients not candidates for surgical revascularization.[16] Absolute contraindications include the presence of ongoing wound infections (e.g., cellulitis, abscess, or purulent discharge), untreated osteomyelitis, necrotizing fasciitis, or any evidence of systemic sepsis. Relative contraindications include severe anemia or malnutrition (serum albumin <2.5 g/dL), active smoking, end-stage renal disease with limited healing capacity, and uncorrected coagulopathy. In the case of a large exposed bone, tendon, or vascular prosthesis without adequate soft tissue coverage, flap reconstruction is the standard of therapy in the presence of a relative contraindication to local wound care.[17] Therefore, when appropriately chosen for the procedure, autologous fat grafting is a safe, minimally invasive, and physiologically active solution for the underlying pathophysiology of failed healing in patients with chronic wounds.[18] Success, conversely, is predicated on strict adherence to correct patient selection, precise surgical technique (atraumatic harvesting, centrifugation or closed system filtration, and microinjection in small aliquots), and ideal perioperative nutritional and oxygen management.[19]

CONCLUSION

Autologous fat grafting is revolutionizing the reconstruction of chronic, non-healing lesions such as diabetic foot ulcers, sacral pressure sores, and arterial insufficiency ulcers. Fat grafting takes advantage of the natural regenerative potential of ASCs and the stromal vascular fraction to induce a lasting paracrine effect of neoangiogenesis, immunomodulation, and extracellular matrix remodeling. It is a safe, biologically active, minimally invasive option for selected chronic wounds, and success is dependent upon strict adherence to appropriate patient selection, precise surgical technique (including atraumatic harvesting, centrifugation or closed-system filtration, and microinjection in small aliquots), and improved perioperative nutritional and oxygen support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Coleman SR. Structural fat grafting: More than a permanent filler. Plastic Reconstruct Surg. 2006;118(3):108S-20.
2. Zuk PA, Zhu M, Mizuno H, Huang J, Futrell JW, Katz AJ, et al. Multilineage cells from human adipose tissue: Implications for cell-based therapies. Tissue Engineering. 2001;7(2):211-8.
3. Rigotti G, Marchi A, Galiè M, Baroni G, Benati D, Krampera M, et al. Clinical treatment of radiotherapy tissue damage by lipoaspirate transplant. Plastic Reconstruct Surg. 2007;119(5):1409-22.
4. Cervelli V, Gentile P, Scioli MG, Grimaldi M, Casciani CU, Spagnoli LG, Orlandi A. Application of platelet-rich plasma in plastic surgery: Clinical and *in vitro* evaluation. Tissue Engineering Part C: Methods. 2009;15(4):625-34.
5. Gentile P, De Angelis B, Pasin M, Cervelli G, Curcio CB, Floris M, et al. Adipose-derived stromal vascular fraction cells and platelet-rich plasma: Basic and clinical evaluation for cell-based therapies in patients with scars on the face. J Craniofacial Surg. 2014;25(1):267-72.
6. Kim WS, Park BS, Park SH, Kim HK, Sung JH. Antiwrinkle effect of adipose-derived stem cell: Activation of dermal fibroblast by secretory factors. J Dermatological Sci. 2009;53(2):96-102.
7. Lee HC, An SG, Lee HW, Park JS, Cha KS, Hong TJ, et al. Safety and effect of adipose-derived stem cell implantation in patients with critical limb ischemia: A pilot study. Circulation J. 2012;76(7):1750-60.
8. Bura A, Planat-Bénard V, Bourin P, Silvestre JS, Gross F, Grolleau JL, et al. Phase I trial: The use of autologous cultured adipose-derived stem cells to treat patients with nonrevascularizable critical limb ischemia. Cytotherapy. 2014;16(2):245-57.

9. Moon KC, Suh HS, Kim KB, Han SK, Young KW, Lee JW, et al. Potential of allogeneic adipose-derived stem cell-hydrogel complex for treating diabetic foot ulcers. Diabetes. 2019;68(4):837-46.
10. Mazini L, Rochette L, Amine M, Malka G. Regenerative capacity of adipose derived stem cells (ADSCs), comparison with mesenchymal stem cells (MSCs). Int J Molecular Sci. 2019;20(10):2523.
11. Marfia G, Navone SE, Di Vito C, Ughi N, Tabano S, Miozzo M, et al. Mesenchymal stem cells: Potential for therapy and treatment of chronic wounds. Int J Molecul Sci. 2021;22(7):3473.
12. Chen L, Tredget EE, Wu PYG, Wu Y. Paracrine factors of mesenchymal stem cells recruit macrophages and endothelial lineage cells and enhance wound healing. PLoS One. 2008;3(4):e1886.
13. Rehman J, Traktuev D, Li J, Merfeld-Clauss S, Temm-Grove CJ, Bovenkerk JE, et al. Secretion of angiogenic and antiapoptotic factors by human adipose stromal cells. Circulation. 2004;109(10):1292-8.
14. Lancerotto L, Chin MS, Freniere BB, Krummel TM, Longaker MT, Lorenz HP. Mechanisms of action of adipose-derived stem cells in chronic wounds. Ann Plastic Surg. 2012;69(3):316-21.
15. Strong AL, Cederna PS, Rubin JP, Coleman SR, Levi B. The current state of fat grafting: A review of harvesting, processing, and injection techniques. Plastic Reconstruct Surg. 2015;136(4):897-912.
16. Cervelli V, Scioli MG, Gentile P, Doldo E, Bonanno E, Spagnoli LG, Orlandi A. Adult stem cell application in wounds and tissue defects: A systematic review. Stem Cell Res Therapy. 2017;8(1):1-10.
17. Tseng S, Kang L, Li Z, Wang L, Li Z, Li T, et al. Adipose-derived stem cells in diabetic foot care: Bridging clinical trials and practical application. World J Diabetes. 2024;15(6):1162-77.
18. Hao Z, Qi W, Sun J, Zhou M, Guo N. Review: Research progress of adipose-derived stem cells in the treatment of chronic wounds. Frontiers Chem. 2023;11:1094693.
19. Liu Z, Li Y, Zhao J, Li Q, Ren J, Wang G. The role of adipose-derived stem cells in the treatment of chronic wounds: A systematic review. Int J Molecul Sci. 2022;23(4):1538.

Cite this article as: Castañeda RB, Arreola ASE, Castañeda MAB, Chávez JHL, Nava MDS, Chong JSR, et al. Autologous abdominal fat graft transposition for ischemic foot lesion with tendon exposure: a case report and literature review. Int Surg J 2026;13:xxx-xx.