

Preoperative Color Duplex Echographical Venous Mapping Before Autologous Fat Graft for Calf Augmentation

A Case Report of Superficial Vein Thrombosis and Prevalence of Intersaphenic Anastomosis

Marco Fracalvieri, MD,* Luigi Contessa, MD,† Marco Salomone, MD,* Enrico Maria Zingarelli, MD,* and Stefano Bruschi, PhD, MD*

Abstract: Autologous fat grafting for calf augmentation is considered an easy and safe technique. Only few cases of potential complications have been described in literature; among them, vein thrombosis was never reported. We report a case of superficial vein thrombosis of the intersaphenic anastomosis after fat graft for calf symmetrization in club-foot syndrome. A color duplex echographical study showed that such intersaphenic anastomoses are present in all patients, but they have an ectatic diameter in 70% of patients with great saphenous vein insufficiency and in 50% of patients without insufficiency. The plastic surgeon should be aware of the presence and topography of such anatomical variations before performing the procedure. Moreover, a preoperative color duplex echographical venous mapping may help the surgeon in avoiding the trauma on vein variants and subsequent complications.

Key Words: thrombosis, superficial vein thrombosis, calf augmentation, autologous fat graft, intersaphenic vein, club-foot syndrome

(*Ann Plast Surg* 2014;73: 137–140)

Calf augmentation has recently become an increasingly requested procedure in body contouring, for both aesthetic and reconstructive purposes. In the current state of art of calf augmentation, silicone implant insertion is the widest documented technique.^{1–5} Other surgical options include autologous tissue injection,^{1,6–9} the combination of the 2,^{1,7} and even free microsurgical transverse rectus abdominis myocutaneous flap.¹⁰

Complications with implant calf augmentation were documented, for example, capsular contractures, infections, seromas, scar hyperpigmentation, implant dislodgement or removal for cosmetic dissatisfaction, and persistent numbness at the ankle.^{1,11,12}

Compartment syndrome after calf augmentation with implant was described.⁷ Literature regarding autologous tissue injection for calf augmentation is still recent and all possible complications are not known yet.^{13–16}

The authors describe a case of postoperative cellulitis and superficial thrombophlebitis caused by the injury of the intersaphenic vein after autologous fat grafting for calf symmetrization in club-foot syndrome. The presence of vein's anatomical variations will be investigated. As a general recommendation, a preoperative color duplex

echographical vein mapping may be performed to avoid these specific or major complications.

CASE REPORT

A 39-year-old female patient requested a monolateral calf augmentation because of congenital calf asymmetry due to club-foot syndrome. She experienced polio as an infant, which gravely atrophied the right calf (Fig. 1). The available surgical options were implant-based calf augmentation or autologous fat transfer. The patient decided for the autologous option. Routine preoperative evaluation included blood cell count, chest x-rays, and electrocardiogram. Deep vein thrombosis prophylaxis with low molecular weight heparin and antibiotic prophylaxis were prescribed. The surgical procedure was performed under narcosis. The fat was harvested from the abdomen with previous injection of 250 mL of saline solution with 0.5% lidocaine with 1:200,000 epinephrine.¹⁷



FIGURE 1. Postoperative photography of the contour deformity of the right calf.

Received March 25, 2012, and accepted for publication, after revision, August 26, 2012.

From the *Plastic Surgery Department and †Vascular Surgery Department, San Giovanni Battista di Torino, University of Turin, Turin, Italy.

Conflicts of interest and sources of funding: none declared.

Reprints: Marco Fracalvieri, MD, Plastic Surgery Department, San Giovanni Battista di Torino, University of Turin, via Cherasco 23, 10100 Turin, Italy.

E-mail: marco@fracalvieri.it.

Copyright © 2013 by Lippincott Williams & Wilkins

ISSN: 0148-7043/14/7302-0137

DOI: 10.1097/SAP.0b013e318271007b

A total of 250 mL of autologous fat was harvested with a blunt cannula (1:1 ratio with the amount of solution injected for tumescent technique).

The harvested fat was centrifuged at 3000 rpm for 4 minutes. Centrifuged fats (150 mL) were injected in the subcutaneous layer of the calf region, using a pulsed pressure on a 10-mL syringe at every withdrawal of the 3-mm blunt cannula. Multilayers and multitunnels were performed in the subcutaneous layer (Fig. 3).

Three weeks later, during a postoperative outpatient follow-up, the patient presented pain in the treated calf region when walking and on manual compression. A venous duplex echography of inferior limbs was prescribed because of suspicion of deep vein thrombosis. All examined deeper veins were compressible and apparently free of thrombosis. The examination highlighted the presence of an anatomical variation: an intersaphenous vein anastomosis crossing through the subcutaneous layer, as shown in Figures 2 and 3. This vein was found incompressible and ascribable to a superficial thrombophlebitis; echoghaphical enhancement compatible with a subcutaneous inflammation, similar to cellulitis, was found to be the cause of the pain (Fig. 4). Antithrombotic therapy and β -lactam antibiotic were prescribed. The clinical recovery was achieved after a week with the complete symptomatic and echoghaphical remission.

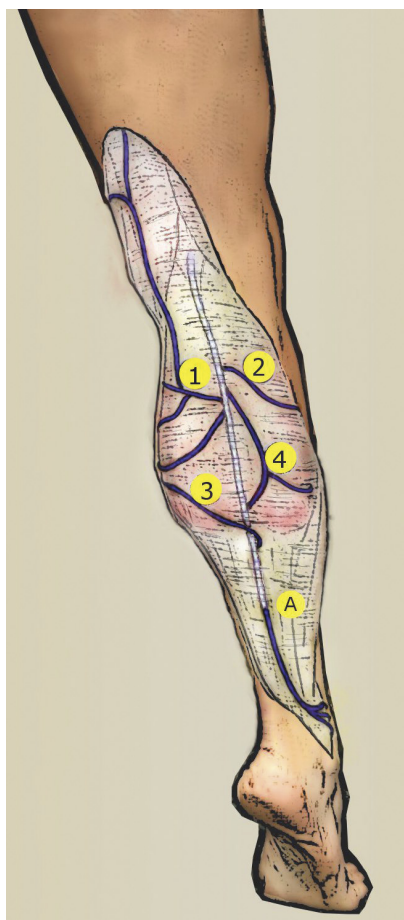


FIGURE 2. Small saphenous vein (A): note the penetration below aponeurosis in the inferior third of the leg. Intersaphenous veins (1–4) crossing the posterior calf region through the subcutaneous layer.

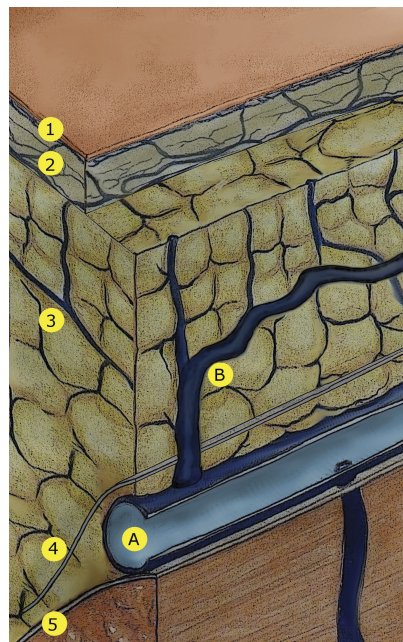


FIGURE 3. Epiderma and subpapillary venous plexus (1), derma and deep dermal venous plexus (2), hypodermis (3), aponeurosis or saphenous fascia (4), gastrocnemius muscle and muscular fascia (5), SSV (A), intersaphenous vein or subcutaneous vein (B) crossing through the subcutaneous layer.

Anastomosis Prevalence

A color duplex echographical study was performed in 60 patients. The cohort was enrolled during follow-up sessions of patients with great saphenous vein (GSV) insufficiency or during the first echoghaphical examination. Characteristics of the patients are summarized in Table 1. This study highlights the presence of intersaphenous anastomosis in all the examined patients, with a direct proportional diameter when compared with the GSV. Consequently, a GSV with a smaller diameter is associated with an intersaphenous anastomosis that has no clinical significance. This finding suggests that such intersaphenous anastomoses have a clinical importance (due to the presence of intersaphenous vein ectasia) in 70% of patients with GSV insufficiency; the percentage falls to 50% in patients without GSV insufficiency (total prevalence 56.6%). When intersaphenous vein ectasia was present, it was always bilateral. No statistical significance ($P > 0.05$) was found when comparing the 2 groups (formed by patients with or without GSV insufficiency) for the variables sex, age, and intersaphenous vein ectasia prevalence.

DISCUSSION

Complications after calf augmentation with implant have been largely documented, for example, Aiache¹¹ reported an incidence rate of 4.8% of capsular contractures, 4.8% of infections, 2.4% of cosmetic dissatisfaction, and less than 2% of persistent numbness at the ankle. Felicio¹² reported an incidence rate of 4% of seromas, 4% of implant removal for cosmetic dissatisfaction, and 1% of implant dislodgement. Niechajev¹ reported an incidence rate of 12% of scar hyperpigmentation. Compartment syndrome after calf augmentation with implant has been described.¹⁸

Given the increase in demand and use of fat transfer, it is necessary to understand its potential complications. Even if literature is replete with clinical series attesting potential fat grafting complications,^{13–16,18}

they are not well defined, and in particular it lacks of reports about calf augmentation.

In the case presented previously, during the fat injection, although performed with a blunt cannula, the repetitive insertion and withdrawal of the cannula traumatized an intersaphenic vein passing through the subcutaneous layer. The vein injury caused thrombophlebitis, simil-cellulitis subcutaneous fat inflammation around the vein, swelling, and pain.

One or more intersaphenic veins may run obliquely to the calf to connect the small saphenous vein (SSV) with the GSV.¹⁹ When one of those (or even an accessory saphenous vein) is present, it passes through the subcutaneous layer above the saphenous fascia.¹⁹

As shown in Figures 2 and 3, this vein crosses the subcutaneous layer, site which is the target of fat graft injection in multilayers and multitunnels. Intersaphenous vein thrombophlebitis may occur when the surgeon is not aware of the presence of intersaphenic anastomosis in the calf region in his specific patients, assuming that the subcutaneous calf region is free of major vascular structures. In fact, as shown in Figures 2 and 3, the SSV is usually protected below the saphenous fascia in the saphenous compartment¹⁹ for the proximal two thirds of the leg, whereas it is subcutaneous only for the distal third.

We performed a color duplex echographical study to evaluate the prevalence of intersaphenic anastomosis, as in literature, it was not yet reported. We found a surprising high prevalence, which justifies an echographical venous mapping of the calf region to avoid this particular type of superficial vein thrombosis or other potential complications described in literature (ascribed generally to fat grafting in body contouring).^{13–16}

Because of the postoperative duplex-guided skin marks of the superficial veins, the surgeon will be aware of the potential anatomical vein variations, their topography and which layer they are crossing, making sure to avoid trauma on the vascular structure when performing the fat injection. For this reason, the authors recommend color duplex echographical venous mapping as a routine preoperative examination



FIGURE 4. Duplex echography of the posterior calf region showing the thrombotic intersaphenous vein in the subcutaneous layer (highlighted in blue): note the perivenous echographical enhancement compatible with cellulitis (highlighted in yellow). Small saphenous vein is protected from cannula insertion during fat injection below the aponeurosis.

TABLE 1. Characteristics of Patients Examined With Color Duplex Echography

Characteristic of Patients	
Male	9 (15%)
Female	51 (85%)
Age, mean (SD), y	55 (10)
With GSI	20
Without GSI	40
Prevalence of intersaphenic anastomosis ectasia	14 (70%) in patient with GSI 20 (50%) in patient without GSI
Total prevalence	34 (56.6%)

A total of 60 patients.
GSI indicates great saphenous insufficiency.

(for either reconstructive or aesthetic purposes), as it is also a noninvasive, low cost, and accurate examination when carried out by experts.

In the authors' opinion, fat grafting is a valid alternative technique to calf implants, due to autologous advantages and the simplicity of the technique. In particular, fat grafting is the authors' first choice in patients with calf hypotrophy because of tissue regeneration and enhanced tissue trophism.²⁰

Possible drawbacks can be identified in the multiple session of injections or touch-ups, required to achieve symmetry or desired volume augmentation, even if fat graft is considered clinically stable in time.²¹ The potential lack of fat in thin patients (low body mass index) can limit the usage of this technique.

CONCLUSIONS

Autologous fat grafting for calf augmentation is considered an easy and safe technique. Only few cases of potential complications were described in literature; in particular, vein thrombosis was never reported. We report a case of superficial vein thrombosis of the intersaphenic anastomosis after fat graft for calf symmetrization in club-foot syndrome. A color duplex echographical study showed that such intersaphenic anastomoses are present in all patients but they have an ectatic diameter in 70% of patients with GSV insufficiency and in 50% of patients without insufficiency. The plastic surgeon should be aware of the presence of those anatomical variations and their topography before performing the procedure: a postoperative color duplex echographical venous mapping can help the surgeon avoid the trauma such as these vein variants and subsequent complications.

REFERENCES

- Niechajev I. Calf augmentation and restoration. *Plast Reconstr Surg.* 2005; 116:295–305.
- Flores-Lima G, Eppley BL. Body contouring with solid silicone implants. *Aesthetic Plast Surg.* 2009;33:140–146.
- Gutstein RA. Augmentation of the lower leg: a new combined calf-tibial implant. *Plast Reconstr Surg.* 2006;117:817–826; discussion 827.
- Aiache AE. Leg contouring with implants. *Clin Plast Surg.* 1996;23:737.
- de la Peña-Salcedo JA, Soto-Miranda MA, Lopez-Salguero JF. Calf implants: a 25-year experience and an anatomical review. *Aesthetic Plast Surg.* 2011;36: 261–270.
- Erol OO, Gurlek A, Agaoglu G. Calf augmentation with autologous tissue injection. *Plast Reconstr Surg.* 2008;121:2127–2133.
- Mojallal A, Veber M, Shipkov C, et al. Analysis of a series of autologous fat tissue transfer for lower limb atrophies. *Ann Plast Surg.* 2008;61:537–543.
- Stampos M, Xepoulas P. Fat transplantation for soft tissue augmentation in the lower limbs. *Aesthetic Plast Surg.* 2001;25:256–261.

9. Pereira LH, Radwanski HN. Fat grafting of the buttocks and lower limbs. *Aesthetic Plast Surg*. 1996;20:409–416.
10. Hui KC, Zhang F, Greenberg L, et al. Calf augmentation using free TRAM flap. *Microsurgery*. 1999;19:227–231.
11. Aiache AE. Calf implantation. *Plast Reconstr Surg*. 1989;83:488–493.
12. Felicio Y. Calfplasty. *Aesthetic Plast Surg*. 2000;24:141–147.
13. Sherman JE, Fanzio PM, White H, et al. Blindness and necrotizing fasciitis after liposuction and fat transfer. *Plast Reconstr Surg*. 2010;126:1358–1363.
14. Ricaurte JC, Murali R, Mandell W. Uncomplicated postoperative lipoid meningitis secondary to autologous fat graft necrosis. *Clin Infect Dis*. 2000;30:613–615.
15. Kuran I, Tumerdem B. A new simple method used to prepare fat for injection. *Aesthetic Plast Surg*. 2005;29:18–22; discussion 23.
16. Talbot SG, Parrett BM, Yaremchuk MJ. Sepsis after autologous fat grafting. *Plast Reconstr Surg*. 2010;126:162–164.
17. Coleman SR. *Structural Fat Grafting*. St Louis, Mo: Quality Medical Publishing; 2004.
18. Niechajev I. Calf augmentation with autologous tissue injection. *Plast Reconstr Surg*. 2009;123:1891–1892; author reply 1892–3.
19. Caggiati A, Bergan JJ, Gloviczki P, et al. Nomenclature of the veins of the lower limbs: an international interdisciplinary consensus statement. *J Vasc Surg*. 2002;36:416–422.
20. Jackson IT, Simman R, Tholen R, et al. A successful long-term method of fat grafting: recontouring of a large subcutaneous postradiation thigh defect with autologous fat transplantation. *Aesthetic Plast Surg*. 2001;25:165–169.
21. Coleman SR. Long-term survival of fat transplants: controlled demonstrations. *Aesthetic Plast Surg*. 1995;19:421–425.