

Complications in Fat Grafting

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KEYWORDS

- Fat grafting • Fat complications • Microdroplet • Microcannulas • Irregularity • Resorption • Intravascular injection
- Neovascularization

KEY POINTS

- Fat grafting complications from overinjection or underinjection volumes are common issues that are dramatically improved by proper instrumentation and the techniques discussed herein.
- Management of contour irregularities created from fat grafting is challenging at times but various methods to improve outcomes after complications occur exist and are discussed herein.
- Serious complications from fat grafting, such as intravascular events, are rare but could occur, especially with smaller injection cannulas and needles, and surgeons must know how to prevent and treat these.

Signs of facial aging are multifactorial. The facial skeleton undergoes resorptive changes, decreasing its support for the overlying soft tissue. The subcutaneous fat, muscle, and dermis of the face also lose volume. In addition, elastin, collagen, and hyaluronic acid are lost from the dermis and the facial ligaments lose their tightness. This combination of losses of supporting structures, soft tissue volume, and elasticity contributes to the appearance of the aging face.

To achieve esthetic harmony, strategies for facial rejuvenation must improve hard and soft tissue atrophy, volume loss, and soft tissue ptosis. At the forefront of addressing these issues is volume augmentation because of its ease of recovery and short downtime. Fat is of particular interest because it is autogenous and permanent, and has been shown to be very successful at providing the augmentation.

As demand for facial augmentation has increased, facial fat grafting procedures have become more common. As a result, certain complications can arise. This article discusses the complications that can arise from fat grafting, their proposed mechanism, and how to prevent and manage them.

Blindness or stroke (intravascular injection)

Blindness or stroke can occur as a result of facial filler or fat injections. In 2012, Lazzeri and colleagues¹ published a review in which they reported 32 cases of blindness due to injectable fillers. Fifteen of the 32 cases were due to fat injection in which none of the patients regained vision.¹ Several other cases of facial fat grafting intravascular injection leading to complications have been reported in the literature.^{2–7}

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Understanding of the pathophysiology is of great importance in preventing and managing this complication.

Mechanism

High-pressure intraarticular injection of fat into the dorsal nasal, angular, or supratrochlear arteries can overcome arterial pressures and cause retrograde movement of embolized fat into the ophthalmic artery and internal carotid (Figs. 1 and 2). When the injection pressure is released, the arterial pressure then embolizes the fat anterogradely from (1) the ophthalmic artery to its terminal retinal and ciliary arteries (blindness) or (2) the internal carotid to the cerebral arteries (stroke).^{1–7}

Prevention

Being well-versed in facial vascular anatomy is of utmost importance to minimize the risk for intraarticular injection. Aspiration before injection helps detect if the needle has been placed intravascularly. Low-pressure injection using small syringes along with small-bore needles or cannulas have also been advocated to lower the risk for intravascular injection. Furthermore, frequent movement of the needle or cannula will avoid large amounts of fat being injected in the same location.

Management

Acute onset of pain is the chief complaint of a retinal artery embolism. Stroke symptoms make take minutes to hours to manifest. Early diagnosis is of utmost importance to improve patient outcomes and attempts should be made to restore retinal circulation within 60 to 90 minutes.⁷ Vigilance for signs and symptoms of stroke or blindness during the injection period is required.

Unfortunately, a strong level of evidence is not available for management of intravascular injection. If symptoms of blindness do arise, the patient should be transferred to a hospital as soon as possible.^{5–7} While waiting for a transfer, attempts should be made to lower the intraocular pressure. One to 2

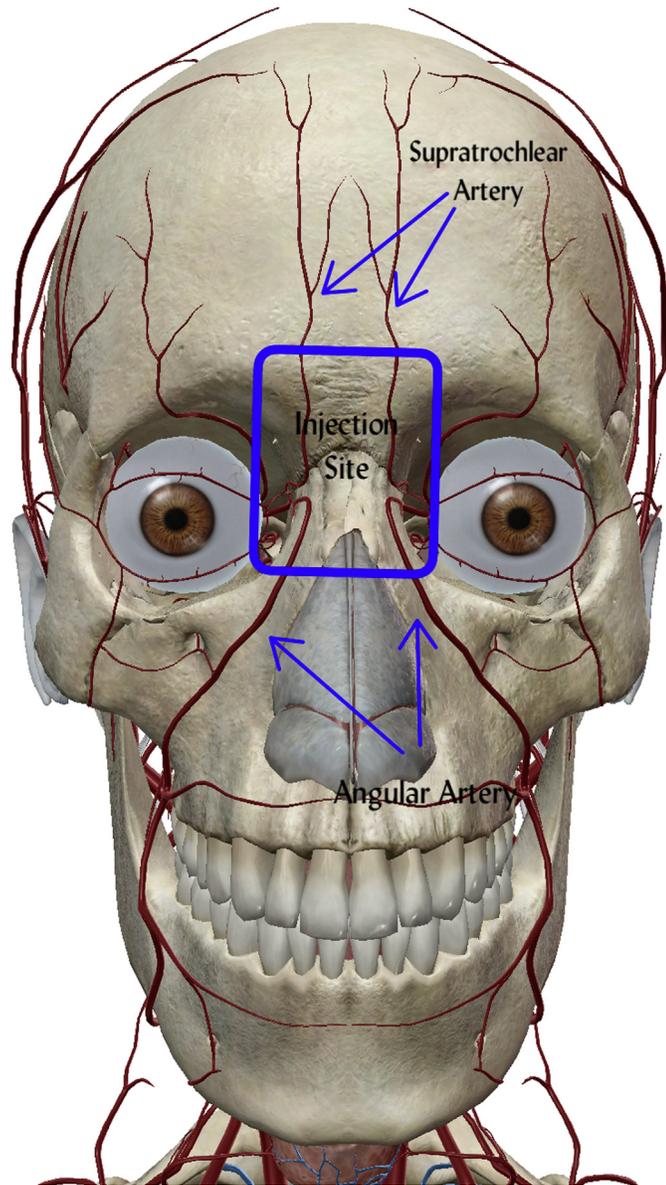


Fig. 1 Vasculature of facial injection sites that commonly lead to blindness.

drops of timolol 0.5% should be placed in the affected eye.⁵⁻⁷ If available, aspirin 325 mg and acetazolamide 500 mg should also be given to the patient.⁵⁻⁷ Ocular massage by indenting the globe 2 to 3 mm for 5 to 15 seconds, followed by sudden release of pressure, is hypothesized to help dislodge the embolus.⁵⁻⁷ Retrobulbar lavage, steroids, heparin drip, and aqueous paracentesis have all been suggested but without strong evidence for their use.⁷

Contour irregularity, unpredictability, and overcorrection and undercorrection

One of the disadvantages of fat grafting is that the amount of fat graft survival can be unpredictable. Although autologous fat is often marketed as a permanent filler, studies show that the range of fat survival is 20% to 80%.⁸ This amount of unpredictability can lead to asymmetry, contour irregularities, and undercorrection. Overcorrection can also occur because some surgeons inject more fat to compensate for the resorption that occurs.

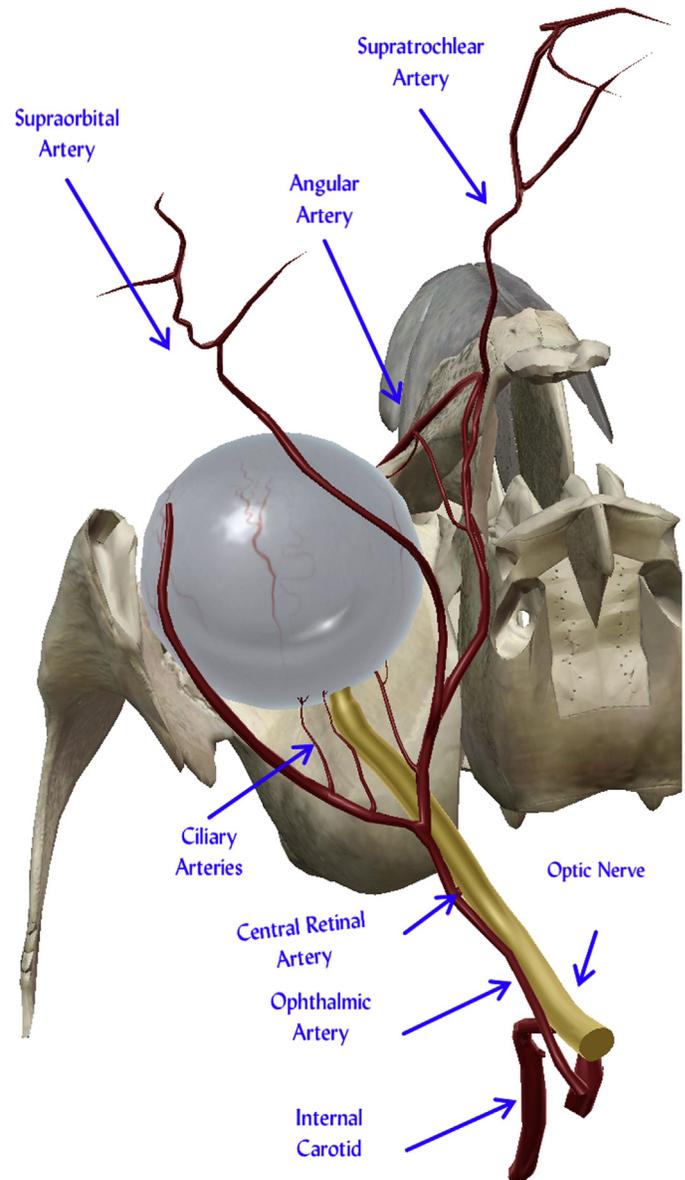


Fig. 2 Periorbital vasculature involved in the retrograde flow of a fat embolus after autologous fat grafting to the face.

Mechanism

Grafted adipose tissue relies on plasmatic diffusion for nourishment until neovascularization occurs. During this period, the grafted fat is in a hypoxic environment and adipocytes furthest away from the host tissue bed will die.⁹ The dead adipocytes will be phagocytized and scar tissue or oil cysts will replace them. This will contribute to contour irregularities and unpredictability.⁹ In addition, contour irregularities can also be a result of superficial deposition of the grafting material.

Prevention

Predictable results in fat grafting necessitate meticulous techniques. Fat should be injected using a microdroplet technique with the diameter of the fat particles being no wider than 2 mm.⁹ This will maximize the amount of fat

cells that have access to plasmatic diffusion during the hypoxic phase, thereby increasing its survival. The microdroplet technique can be performed using a 1 mL syringe and microcannulas. In addition, pretunneling the tissue before injection decreases tissue pressure and tension and increases fat cell survival.⁹ Because of the unpredictable nature of fat survival, deeper placement is warranted, especially in the tear trough area, to minimize contour irregularities (Fig. 3).

Recent studies have also shown that augmenting platelet-rich plasma to fat grafting increases fat survival and

predictability.^{10,11} The optimal ratio of platelet-rich plasma to fat has not yet been determined and further prospective studies are needed to confirm the preliminary results.

A recent study has shown that lidocaine in the tumescent solution may be cytotoxic to adipocyte-derived stem cells.¹² In this study, the number of viable adipose-derived stem cells after lipoaspiration in the lidocaine group was 367,000 versus 500,000 in the no lidocaine group. The investigators recommend using tumescent solution without lidocaine to increase fat graft survival.¹²



Fig. 3 Because of the unpredictable nature of fat survival, deeper placement is warranted, especially in the tear trough area, to minimize contour irregularities.

Management

Undercorrection is usually diagnosed after swelling has subsided and can be corrected with fillers or additional fat grafting. Overcorrection is a little more tedious to correct; however, initial management can begin with Kenalog injections, massages, and ultrasound. In severe cases, liposuction or excision of the grafted fat may be needed. Contour irregularities can be corrected by a combination of techniques used to correct undercorrection and overcorrection.

Swelling and bruising

Edema and ecchymosis are common after fat grafting, especially in the periorbital area. Patients should be made aware of the prolonged edema that may occur.

Mechanism

The inflammatory process that takes place during the healing period draws macrophages, lymphocytes, and inflammatory cytokines to the grafted site, all of which contribute to postoperative swelling.⁹ The high vascularity of the face makes it very prone to bruising, therefore measures need to be taken to prevent it.

Prevention

Patient counseling is important before fat grafting to prepare the patient with realistic expectations for the postoperative healing. If medically appropriate, the patient should be counseled on avoidance of antiplatelet medications for at least 1 week before surgery. Dietary supplements such as ginseng, *Ginkgo biloba*, vitamin E, fish oil, and garlic should also be stopped. Although, conflicting data exist, *Arnica montana* and bromelain can be recommended to the patient to help with postoperative swelling and bruising.

Management

Facial lymphatic massage and therapeutic ultrasound can help with postoperative edema. Makeup is usually recommended postoperatively to cover up the bruising.

Summary

Autologous fat has properties that make it a candidate for the ideal filler material for grafting. Unfortunately, there are

also some drawbacks to autologous fat grafting that can affect its desirability. A surgeon needs to be an expert in facial anatomy and pay meticulous attention to detail throughout the harvesting, preparation, and injection process to have predictable results. Aspirating before injection, using small-bore needles or cannulas, low-pressure injections, and frequent movement of the syringe have all been advocated to lower the risk for intravascular injection. Elimination of lidocaine from the tumescent solution, addition of platelet-rich plasma, and microdroplet injection technique all seem to contribute to its predictability and make it a more desirable filler. Further prospective studies are needed to fortify these conclusions and make autologous fat the ideal filler material.

References

1. Lazzeri D, Agostini T, Figus M, et al. Blindness following cosmetic injections of the face. *Plast Reconstr Surg* 2012;129:995–1012.
2. Hong DK, Seo YJ, Lee JH, et al. Sudden visual loss and multiple cerebral infarction after autologous fat injection into the glabella. *Derm Surg* 2014;40:485–7.
3. Dreizen NG, Fram L. Sudden unilateral visual loss after autologous fat injection into the glabellar area. *Am J Ophthalmol* 1989;107:85–7.
4. Butterwick KJ, Nootheti PK, Hsu JW, et al. Autologous fat transfer: an in-depth look at varying concepts and techniques. *Facial Plast Surg Clin North Am* 2007;15:99–111.
5. Prado G, Rodriguez-Feliz J. Ocular pain and impending blindness during facial cosmetic injections: is your office prepared? *Aesth Plast Surg* 2017;41:199–203.
6. Carruthers JD, Fagien S, Rohrich RJ, et al. Blindness caused by cosmetic filler injection: a review of cause and therapy. *Plast Reconstr Surg* 2014;134:1197–201.
7. Loh K, Chua J, Lee H, et al. Prevention and management of vision loss relating to facial filler injections. *Singapore Med J* 2016;57:438–43.
8. Niechajev I, Sevcuk O. Long-term results of fat transplantation: clinical and histologic studies. *Plast Reconstr Surg* 1994;94:496–506.
9. Mashiko T, Yoshimura K. How does fat survive and remodel after grafting? *Clin Plast Surg* 2015;42:181–90.
10. Serra-Mestre JM, Serra-Renom JM, Martinez L, et al. Platelet-rich plasma mixed-fat grafting: a reasonable pro-survival strategy for fat grafts? *Aesth Plast Surg* 2014;38:1041–9.
11. Sasaki GH. The safety and efficacy of cell-assisted fat grafting to traditional fat grafting in the anterior mid-face: an indirect assessment by 3D imaging. *Aesth Plast Surg* 2015;39:833–46.
12. Goldman J, Wang W, Fang X, et al. Tumescent liposuction without lidocaine. *Plast Reconstr Surg* 2016;4:e829.