

# Complications of Fat Grafting



## How They Occur and How to Find, Avoid, and Treat Them

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### KEYWORDS

- Fat grafting • Adipose-derived stem/stromal cell • Tissue necrosis • Oil cyst • Calcification
- Blindness • Infection

### KEY POINTS

- Blindness and stroke have occurred as a result of arterial injection of fat tissue in almost every part of the face. The injection of large boluses and the use of sharp needles/cannulas should be avoided in the face.
- Most of the common complications such as no/minimal graft retention, infection, oil cysts, and calcifications are related to necrosis of grafted fat. To minimize fat necrosis, surgeons should optimize each step from liposuction to lipoinjection. Injection as small aliquots/noodles of fat (preferably 2 mm in diameter) is particularly important.
- Although fat grafting is a minimally invasive surgical procedure, surgeons have to be cautious to avoid any unexpected damage to the donor and recipient sites to minimize the perioperative risk and complications.

### INTRODUCTION

Recent technical and scientific advances in fat grafting procedures and concepts have improved predictability of fat grafting. Large-volume fat injection is gaining much attention as an attracting procedure for body contouring and reconstruction, but an increasing number of complications also has been recognized over the world.<sup>1</sup> In this article, typical complications after fat grafting are described, as well as an explanation of how and why they occur, and how surgeons can avoid and treat complications.

### COMPLICATIONS AFTER FAT GRAFTING PROCEDURES

Most of the common complications are related to necrosis of grafted fat, which can be minimized

by technical improvements, but there are rare but catastrophic complications such as blindness and stroke.<sup>2</sup> Typical complications and possible complaints by patients will be discussed.

#### ***Embolization: Blindness, Strokes, and Skin/Tissue Necrosis***

Probably the most devastating potential complication of fat grafting is embolization after intravascular injection. Blindness from a fat injection was first reported in 1988.<sup>3</sup> Few details were given, but the basic presentation was identical to the later reports. The patient experienced excruciating pain accompanied by immediate and permanent loss of vision in 1 eye. There have been reports of permanent unilateral blindness from central retinal artery occlusion by fat grafting, frequently

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accompanying stroke and skin necrosis. Although most instances of central retinal artery occlusion and blindness resulted from fat injection in the nose or periorbital region,<sup>3–5</sup> some were reported with fat injection into the nasolabial folds<sup>6</sup> or even the lower lip.<sup>7</sup>

Obviously, arterial embolization can also affect the mucosa, conjunctiva, or skin and result in necrosis. There has been a report of blindness, stroke, and skin necrosis from the injection of only 0.5 mL of filler into the left side of the nasal bridge.<sup>8</sup> Even a small amount injected into the lower face has been reported as having devastating complications; unilateral blindness and brain infarction occurred after the injection of only 0.5 mL into a nasolabial fold.<sup>6</sup>

### **How it occurs?**

The retinal artery and posterior ciliary arteries are proximal branches of the ophthalmic internal carotid arteries. If the opening to the needle is in the lumen of an artery, the filler will be injected into the lumen of the cannulated artery. As more pressure is applied to the plunger, the filler displaces the arterial blood and travels as a column proximally past the origin of the retinal artery. A tiny amount of the filler slipping into the retinal artery can precipitate a central retinal artery blockage, usually resulting in permanent blindness. It is also possible to force the column back into the internal carotid artery and embolize into any area supplied by the internal carotid area, and this may result in a stroke.

### **How to avoid?**

To avoid such complications, do not use sharp needles. Additionally, one should limit bolus size, limit syringe size (only 1 mL syringe to the face), and avoid using ratcheting guns. Small and sharp needles/cannulas are much more likely to perforate the wall of an artery and cannulate the artery lumen than are the larger, blunter instruments. Therefore, extreme caution should be taken when sharp needles of any type are used to inject particulate matter into the face.

The volume placed with each pass of the cannula should also be limited. Infiltration of less than 0.1 mL with each pass of the cannula is recommended in the face. To be especially safe, aliquots of less than 0.033 or 0.02 mL are preferable in the periorbital region. Additionally, a vasoconstricted artery is harder to cannulate than a vasodilated one, so epinephrine should be considered for use at the injection site for the placement of fillers. When using a larger syringe (10 or 20 mL) for infiltration of the fat, the surgeon's control over the volume injected is less than with the smaller

syringe, so it is easier to mistakenly inject a larger amount or to inject with a high pressure. Thus, it is strongly recommended to use only 1 mL Luer-Lok syringes for subcutaneous infiltration into the face. Blindness has also occurred following soft tissue injections with assistive mechanical devices that may create strong pressures during the injection of soft tissues.

### ***Fat Necrosis: Calcifications and Oil Cysts***

Necrosis of grafted fat tissue induces cicatrization, calcifications, and oil cysts if the necrosis size is substantial. Although a single dead adipocyte (50–150  $\mu$ ) can be completely absorbed, significant numbers of oil drops are replaced with collagen matrix (cicatrization).<sup>9</sup> If the cicatrization has a central tiny oil drop (<1 mm), chronic inflammation persists and a sand-like macrocalcification (0.3–2 mm) can develop over the first 5 years. In the event that the fat necrosis is large in size (>10 mm), the necrotic tissue becomes an oil cyst within 6 to 12 months after grafting, which presents never-ending inflammation. Oil cysts are permanently problematic; they neither become silent, nor reduced in size.<sup>1</sup>

Oil cysts can occur after roughly performed fat injection and are more likely to be seen after large-volume fat grafting such as the breast and buttock. It should be noted that the well-projected breast and buttock with a tight skin envelop are uncommon outcomes after fat grafting (common after synthetic implant placement) and can result from oil cyst formation (**Fig. 1**).

### **How it occurs?**

Dead adipocytes become oil droplets and are first surrounded by infiltrated M1-type (inflammatory) macrophages for phagocytosis.<sup>9</sup> The absorption of oil is a very slow process; it takes weeks for a 1 mm oil droplet to be completely absorbed. At a later stage, stratified layers of M2-type (anti-inflammatory) macrophages surround the M1 macrophages and form a fibrous cyst wall. The formation of cyst wall stops the oil absorption process, and the size of oil cysts will not change any later than 1 year after surgery, although the calcification process of the cyst wall continues to progress over several years due to the persisting inflammation.<sup>1</sup>

### **How to avoid?**

Recent findings on the mechanism of fat graft survival and regeneration suggested that fat particles with a more than 2 to 3 mm diameter cannot be engrafted at 100%. Fat necrosis after grafting largely depends on the injection technique/volume and microenvironments of the recipient site. If one

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