



# Complications and management after a nonsurgical rhinoplasty: A literature review

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## Abstract

Nonsurgical rhinoplasty with injectable fillers has become an increasingly popular option in recent years. Their rise in popularity has been driven by a number of factors, including their minimally invasive nature and the cost lower than surgical option. Physicians should keep in mind that there are many possible complications, especially in the hands of a novice injector. Fortunately, most complications are minor and transient in nature, although the patient may consider them aesthetically displeasing and unacceptable. Major complications are rare; however, an inadequate treatment can produce transient to permanent damage for the patient. A review of the medical literature from 2002 was performed to gather information on main complications after nasal injections using the databases of the National Library of Medicine, Ovid MEDLINE, and Cochrane Library. Understanding the basic anatomical knowledge of the midface, especially the vascular system, is fundamental to prevent the appearance of complications. However, recognize immediately the symptoms and know the correct treatment in case of complications is the only way to minimize permanent bad outcome.

## KEYWORDS

filler, nonsurgical rhinoplasty, cosmetic medicine

## 1 | INTRODUCTION

The use of injectable fillers has increased its popularity as an alternative to facial cosmetic surgery, as reported by the International Society of Aesthetic Plastic Surgery (International Society of Aesthetic Plastic Surgery, ISAPS Global Statistics). Filler injections allow to obtain excellent results owing their relatively easy nonsurgical delivery, rapid results, and low-cost office-based procedure.

Surgical rhinoplasty, according to ASAPS statistics (<http://www.surgery.org/sites/default/files/ASAPS-Stats2016.pdf>), is the sixth of the most requested procedures; however, nonsurgical rhinoplasty with fillers in the last few years has shown to be an effective alternative for patients who looking for an aesthetic improvement of the nose.

Fillers can sculpt the nasal shape by injections in the space between the skin and nasal skeleton and this technique called

“nonsurgical rhinoplasty” grown up during these years because their effects are visible immediately after treatment and patients can return to their normal activities on the same day. (Kim & Ahn, 2012)

Although fillers generally are considered safe, complications may occur including immunoreactions, infections and cellulitis, skin necrosis, granuloma formations, and more severe adverse reactions as ophthalmic and retinal artery occlusion or embolization (Daines & Williams, 2013; Lazzeri et al., 2012; Park et al., 2012; Park, Seo, Kim, & Chang, 2011).

Understanding the basic anatomical knowledge of the midface, especially the vascular system, is fundamental to reduce the risk of developing complications during nasal cosmetic injections.

With this review, we want to focus on the main complications associated with nonsurgical rhinoplasty procedure and on their management.

## 2 | METHODS

A literature search was performed to gather information on main complications after nasal injections from reports published from 2002 up to January 2018. The databases of the National Library of Medicine, Ovid MEDLINE, and Cochrane Library were searched using the following Boolean string: (soft tissue augmentation OR filler OR injectable) AND (complication OR adverse event OR embolism). The search was limited to the English language literature. In addition, the references cited in the identified articles were reviewed to identify any additional reports.

Reports of “moderate” and “severe” complications following use of injectable filler were selected for this review; these included herpes simplex virus infections, anaphylaxis, nodules and granulomas, soft-tissue necrosis, filler embolization resulting in impending necrosis and blindness.

The only filler materials included were those that had been approved by the US Food and Drug Administration (FDA) at the time of the review. These materials were collagen, hyaluronic acid (HA), polymethylmethacrylate suspended in collagen, calcium hydroxylapatite (CaHa), poly-L-lactic acid, and injectable dermal matrix. Autologous fat, liquid silicone, and other non-FDA-approved substances were excluded.

## 3 | NONSURGICAL RHINOPLASTY

### 3.1 | Anatomy

The success of nonsurgical rhinoplasty depends on the personal ability of the injector, the anatomic characteristics of the patient's nose (thickness and quality of the skin and the soft tissue, nasal size, shape, and strength of the cartilage and bone) (Jung et al., 2000; Tardy Jr., 1997) and the recognition of such individual variation.

A good knowledge of the soft tissue anatomy of the nose and its vascular system represents the first step to minimize complications.

Before starting injection, the specialist should be aware of the following characteristic:

- The soft tissue of the nasal bridge is the thickest at the nasion and the thinnest at the rhinion, which is the junction of the upper lateral cartilages and the nasal bones.
- There are four layers between the skin and the bony-cartilaginous framework: superficial fatty layer, fibromuscular layer, deep fatty layer, and periosteum or perichondrium.
- A thicker and oily skin makes injections more difficult because post treatment edema occurs more often and create a pleasing 3-D shape is more challenging. However, an advantage of having thicker skin is that minute irregularities or asymmetry is camouflaged more easily compared with patients with thin skin.
- Major blood vessels of the external nose are located in the superficial muscular aponeurotic system (SMAS) layer or the superficial fatty layer (Jung et al., 2000). Therefore, the ideal layer for filler

injection is the deep fatty layer located between the SMAS and the perichondrium or periosteum to minimize the risk of embolization.

- The ophthalmic artery, a branch of the internal carotid artery, mainly supplies blood to the upper part of the nose via the anterior ethmoid artery and the dorsal nasal artery; the facial artery, a branch of external carotid artery, gives rise to the angular and superior labial arteries that supply the lower part of the nose. Here, we have two columellar arteries following the medial cartilaginous crus; the nasal base hosts the lateral nasal artery that creates a subdermal plexus; nasal tip hosts columellar arteries and lateral nasal arteries create arcades; midline hosts nasal dorsum and glabella where nasal dorsal arteries provide vascularization from the angular and the ophthalmic arteries.

The main anatomical features of the nose and its vascular system are represented in Figure 1.

### 3.2 | Nonsurgical rhinoplasty technique

The ideal and safe layer for filler injection is the deep fatty layer located between the SMAS and the perichondrium or periosteum, which maintain the amount of filler injected in the midline.

After comparing and examining the ideal nose shape and the patient's nose shape, decide how to perform the injections. It is possible to proceed with or without any local anesthesia and for many authors it can be useful to mark the midline to prevent the asymmetry and the main vascular complications.

Filler is usually injected in the order of the radix; rhinion; tip; and, finally, the supratip area (Figure 2).

Injection sites were the following:

- above the hump to ameliorate nasofrontal angle,
- above the anterior nasal spine to project the tip of the nose and ahead of the anterior part of the medial crura to enhance columella,
- above the tip of the nose (by percutaneous or endonasal approach) to reshape it and create a supratip break and above upper lateral cartilages in case of deficiency.

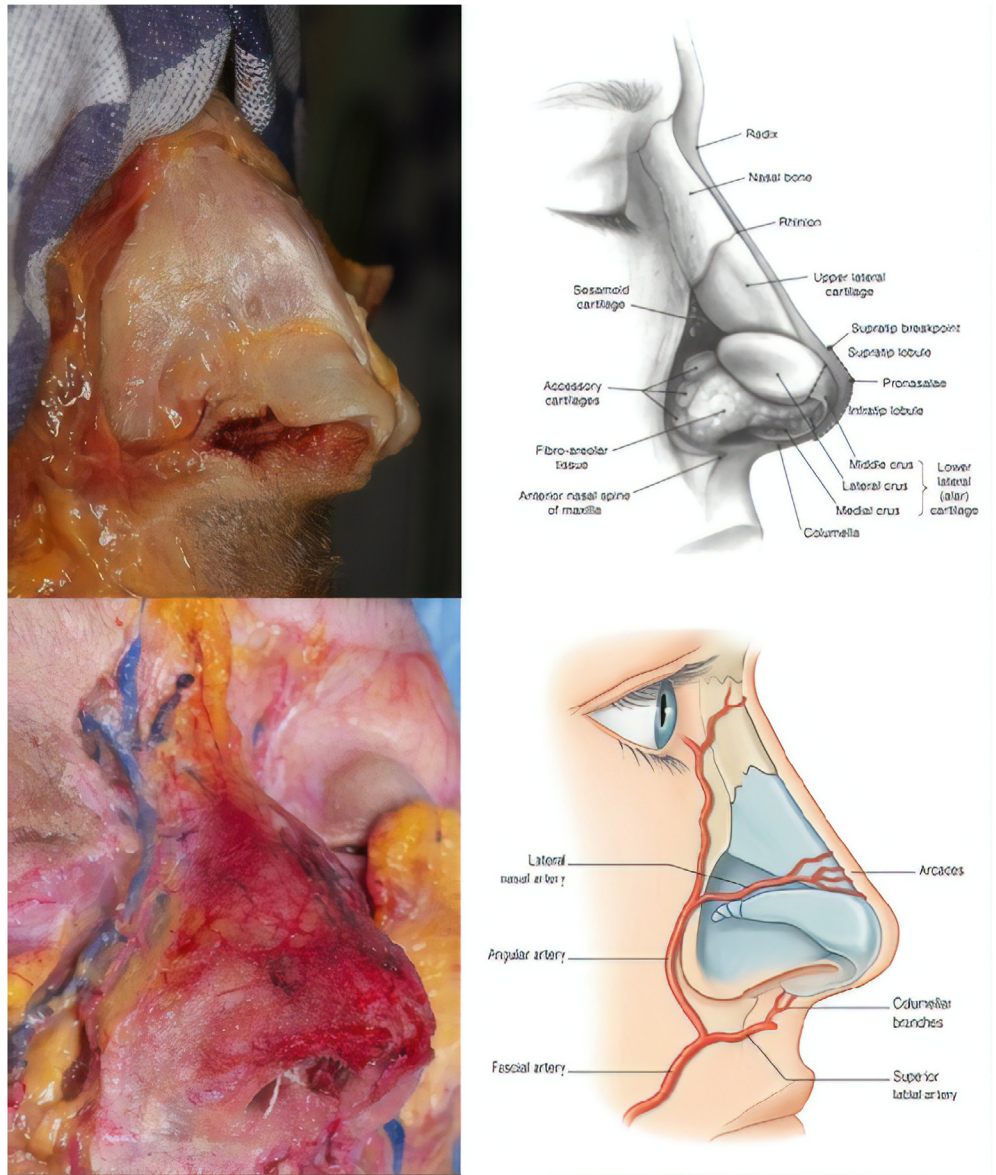
The nasal dorsum should be treated using a threading technique along the midline, injecting a small amount of HA and, after injection, the HA should be gently massaged to avoid contour irregularities.

The nasal sidewall is treated using small amounts of HA, through a crosshatching technique, with at least 15-minute post injection massage. Because of the high risk of vascular compromise, the skin of the nasal sidewall should be continually assessed during injections.

More than any other area, the nasal tip skin must be treated with small amounts of HA and constant assessment of skin perfusion to avoid potentially disastrous sequelae of nasal tip skin compromise.

To be more conservative, preventing adverse reactions, and to proceed in a safely way in order to give the desired nasal shape, injections are performed using a small amount of filler through the linear threading technique. Specialists can use a sharp needle or a blunt cannula; however, a blunt cannula is recommended for beginners because there is relatively less possibility of complications such as intravascular injection.

**FIGURE 1** Anatomy of the nose with the main point and planes of injections (upper side). The ideal and safe layer for filler injection is the deep fatty layer located between the SMAS and the perichondrium or periosteum, which maintains the amount of filler injected in the midline. Vascular system nasal-ophthalmic (lower side). Note the dense anastomotic system between the nasal arteries and the ophthalmic arteries, such that intravascular injections can result in serious complications such as blindness



Volume range of the filler injected was between 0.2 and 1.5 mL (Rohrich, Ghavami, & Crosby, 2007).

After injections, no special dressings no prescription for antibiotics are needed.

### 3.3 | Complications of nonsurgical rhinoplasty

Although soft-tissue fillers have a very favorable safety profile, adverse events can occur.

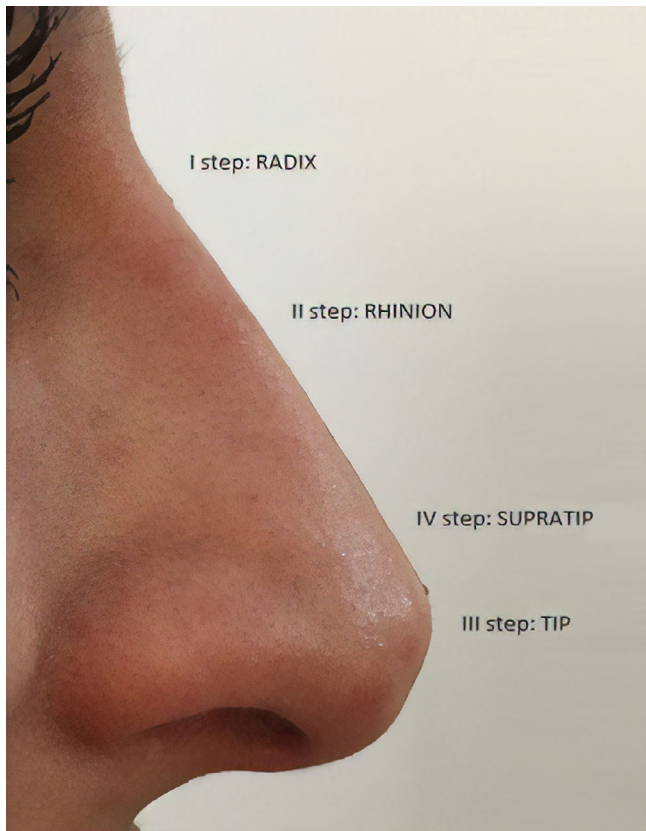
It is possible to classify complication in two groups:

1. Self-limited complications: relatively common and potentially related to improper technique (Gladstone & Cohen, 2007; Lowe, Maxwell, & Patnaik, 2005).
2. Severe complications: less frequent but more severe than the reactions mentioned above. It is possible to group them based on severity into minor and major and may appear early or delayed compared to the time of cosmetic procedure.

#### 3.3.1 | Self-limited complications

The most common complications after filler injections are swelling, bruising, erythema, hypersensitivity, nodules, lump, and asymmetry.

- Swelling and bruising are the main complications appearing immediately after filler injections; they are caused by vascular damage by the needle.
- Erythema is another common complication. Usually, it is transient but sometimes may evolve in permanent telangiectasias requiring a special treatment.
- Hypersensitivity; occasionally, related to the filler ingredients. The main symptoms are pain and erythema, accompanied by pruritus and fever. In most cases, the symptoms subside as the causative substance disappears; sometimes they can rarely lead to anaphylactic shock (Bergerat-Galley, Latouche, & Illouz, 2001).



**FIGURE 2** Four steps of nonsurgical rhinoplasty

- Nodules; their development is a common complication due to the use of fillers for soft tissue augmentation and commonly they are categorized as inflammatory or noninflammatory. Inflammatory nodules may appear anywhere from days to years after treatment, whereas noninflammatory nodules are typically seen immediately after implantation and are usually secondary to improper placement of filler.
- Lumps can form after filler injection; these are due to either granuloma or nodule formation. A granuloma is an immune-mediated response to an injected foreign body and is formed by accumulation of immune response-related cells, such as lymphocytes, to eliminate the foreign body (Matarasso, Carruthers, & Jewell, 2006).
- Asymmetry is one of the most common complications of nonsurgical rhinoplasty. To prevent it, the needle must be placed precisely in the midline, and the direction of the bevel should be toward the median plane. When injecting filler to correct a deviated nose, it is prudent to watch the shape of the nose closely while slowly injecting small amounts of filler to prevent an improper placement of the filler.

### 3.3.2 | Severe complications

Severe complications are not so frequent but may cause serious discomfort to the patient and require, in most cases, specific and prolonged treatments. They may appear early or delayed, after the

cosmetic procedure and not always resolve completely, remaining in partial or total functional limitations. The most common severe complications are granulomas and vascular embolism causing skin necrosis or visual impairment.

- Granuloma is a rare delayed major adverse event. These have been reported to occur in roughly 0.1% of the patient population, mostly after the injection of permanent or semipermanent fillers (Lowe et al., 2005). They usually occur within the first 6 months after injection but can also occur as late as years after.
- Skin necrosis is one of the most severe and feared early-occurring complication, due to interruption of the vascular supply to the area by direct injury of the vessel, compression of the area around the vessel, or obstruction of the vessel by the filler material (Georgescu, Jones, McCann, Anderson, & Anderson, 2009). This process is often associated with prolonged blanching and possibly pain at the site of injection, followed later by a dusky discoloration, although Hirsch and colleagues reported on an impending necrosis with the first symptom presenting only 6 hours after injection and a dusky purple discoloration of the affected area (Park et al., 2012).

The dorsal and external nasal arteries are also branches of the ophthalmic artery, which also provide collateral flow to the nasal tip. Isolated reports of tip necrosis have been published in the literature following the use of fillers of all types, and it has been documented as a rare complication of surgical rhinoplasty.

The mechanism behind this is assumed to be compression, occlusion, and/or embolization of these vessels (Grunebaum, Bogdan Allemann, Dayan, Mandy, & Baumann, 2009). These events are clearly not unique to the nasal vessels, with similar reports seen following administration of fillers in the forehead, glabellar, temple, and the nasolabial region (Carruthers, Fagien, Rohrich, Weinkle, & Carruthers, 2014).

- Vision impairment and the consequent blindness are the worst severe complications of filler injections. Blindness after filler's injection is extremely rare and was first reported by von Bahr more than 50 years ago. These complications are caused by an accidental intravascular injection of filler that, especially at nasal dorsum, glabella (dorsal nasal artery) and on the sidewall of the nose (angular artery), if carried out with sufficient pressure, can enter in the supratrochlear or supraorbital arteries. Filler particles can retrogradely reach the origin of the artery to the ophthalmic artery. Following systolic pressure, filler can be transported along the ophthalmic artery or the central artery of the retina, causing a sudden loss of vision.

In 2012, Lazzeri et al. conducted a systematic review on iatrogenic blindness after facial cosmetic injections, they reviewed clinical data of 32 patients, and suggested some precautions to avoid such complications (Lazzeri et al., 2012). Similarly, Park and his colleagues enrolled 44 patients in a Korean national survey and investigated their clinical manifestations and visual prognosis of retinal artery occlusion resulting from the surgery (Park et al., 2012). In a recent review by Li et al. 75 cases of blindness secondary to facial

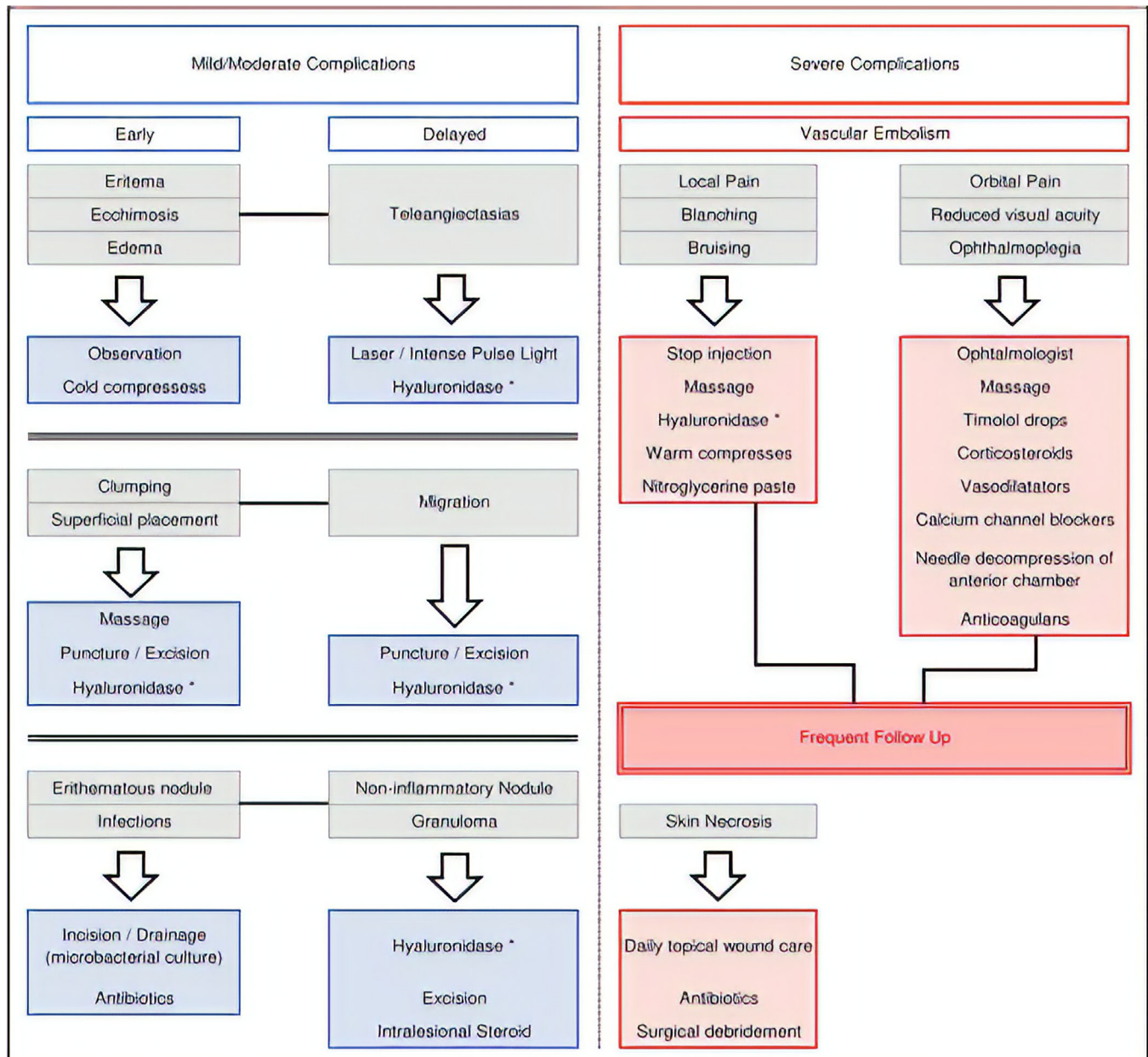
injections were recorded; 25% of the cases were secondary to nasal dorsum injections (Li, Du, & Lu, 2015). The hypothesis proposed by the authors is based on the presence of an anastomosis of the nasal area, consisting of a dorsal nasal artery from the ophthalmic artery, an angular artery, and a lateral nasal artery from the facial artery. Schanz et al. also underlined the importance of a good knowledge of standard vascular and its variant is essential to avoid vascular complications not only represented by nasal skin necrosis but also by blindness (Schanz, Schippert, Ulmer, Rassner, & Fierlbeck, 2002). HA filler are more frequent related to blindness by a study conducted by Beleznay et al. in 2015 (23% instead of 2% related to the use of

CaHA in a group of 98 patients). Probably, this could be related to the use more frequent of this kind of filler instead of the kind of material used (Beleznay, Carruthers, Humphrey, & Jones, 2015).

Consequence of all these studies, it is common the use of cannula instead of needle to reduce the risk of vascular embolism and prevent these severe complications.

### 3.4 | Management of complications

The injections of dermal filler, if carried out with the right precautions, are safe and the associated complications are minimal. However,



\* The use of Haluronidase is limited to complication after HA dermal filler.

**FIGURE 3** Management of complication after nonsurgical rhinoplasty. Complication after cosmetic procedure using filler is rare. However, when occur, it is necessary to recognize them immediately in order to intervene with the most appropriate treatment depending on the onset, the severity of complication and the kind of filler injected (hyaluronidase should be used only after HA filler injections)

when appear, complications should be immediately recognized and correctly treated. It is fundamental remind that prevention is always better and easier than treatment.

Generally, to prevent adverse events filler should be injected slowly and gently, and we suggest the use of 27G 13 mm needle or 38 mm 25G cannula. It is essential to aspirate to verify a negative flashback before making any filler injection. To minimize intravascular injection in nose augmentation, the filler should be placed along the midline of the radix, dorsum, supratip, and nasal spine, and below the subcutaneous and musculoaponeurotic system layer, in which the major vasculature of the nasal skin is located (Humphrey, Arkins, & Dayan, 2009).

However, when occur, it is necessary to recognize them immediately in order to intervene with the most appropriate treatment. An algorithm for treatment of mild-to-severe complication following filler injection is reported in Figure 3.

### 3.4.1 | Management of self-limited complications

Transient self-limited complications usually do not cause serious discomfort to the patient. They appear immediately (bruising, swelling, and ecchymosis) or a few hours after the cosmetic procedure (erythema) and resolve spontaneously within a few days without need of any therapy but just following some good rules (De Boule, 2004).

To reduce this kind of adverse events, piercing of muscular layers must be minimized during filler injection and the injection site should accurately cleaned with an alcohol swab. Patients should be informed not to take blood thinners, such as aspirin, 1 week before the procedure and the application of ice packs on the injection site immediately post procedure helps minimize the appearance of these adverse reactions (Rohrich, Monheit, Nguyen, Brown, & Fagien, 2010).

If bleeding occurs during procedure, the injection site should be covered with gauze and pressed for several minutes to avoid the formation of a hematoma.

After cosmetic injections, patients should avoid direct sun exposure, hot-humid places (saunas, spas, swimming pools), intense physical activity and, in the early hours, the application of cosmetic products.

When erythema evolves in permanent telangiectasias, a treatment with intense pulsed light therapy or pulsed dye laser is required (Sclafani & Fagien, 2009).

### 3.4.2 | Management of severe complications

Nodules and erythema that persist beyond the first few days of treatment may be signs of inflammation (Lemperle & Duffy, 2006; Rohrich et al., 2010).

In these cases, massage, antibiotic therapy, and administration of hyaluronidase for HA products have proven helpful (Sclafani & Fagien, 2009).

As reported by Alam et al., true granulomas appear late, after weeks or months, and they respond well to intralesional steroids or incision and drainage. In case of mild/moderate complication (lumps, asymmetries, nodules, or granulomas) due to HA filler, it is possible to

use hyaluronidase (Alam et al., 2008). The effective dosage depends on the extent of the area to be treated: less than 2.5-mm area: 10–20 U single injection; area of 2.5 mm–1 cm: two to four injection points with 10–20 U per injection point. In both cases, if required, repeat injection (Signorini et al., 2016).

Vascular-related events are the complications most likely to result in permanent sequelae, so an appropriate treatment should be started immediately upon suspicion of vascular compromise.

Dayan et al. have suggested the use of hyaluronidase in all cases of vascular compromise, independent of the filler type, due to its edema-reducing benefits and theoretical advantage in reducing occluding vessel pressure. In his 5-year retrospective review, he reported 2089 injectable soft-tissue filler treatments and just 41 cases of complications, most of them after injections with CaHA; of these, 2 were severe cellulitis, 1 was a nodule formation, and 1 was a nasal sidewall skin necrosis related to nose treatment (injection of nasolabial fold). However, after treatment, he has demonstrated the complete recovery of the patients (Dayan, Arkins, & Mathison, 2011).

The consensus treatment in case of intravascular injections is based on massaged and application of warm compresses to increase vasodilatation (De Boule, 2004). Utilization of nitroglycerine paste, hyaluronidase and systemic or topical steroids to reduce associated inflammation, may be useful (Alam & Dover, 2007; Sclafani & Fagien, 2009). De Lorenzi proposed a new protocol to manage acute filler related vascular events. He called it HDPH High Doses Pulsed Hyaluronidase. The current protocol is exceedingly simple and involves solely the use of hyaluronidase in repeated high doses. Despite the simplicity of the treatment, it has proven itself to be very successful. There has been no partial or complete skin loss associated with this protocol since its implementation if the protocol was implemented within 2 days of the ischemic event onset. The protocol involves diagnosis and repeated administration of relatively high doses hyaluronidase into the ischemic tissue repeated hourly until resolution (as detected clinically through capillary refill, skin color, and absence of pain). The dosage of hyaluronidase varies as the amount of ischemic tissue, consistent with the new underlying hypothesis that we must flood the occluded vessels with a sufficient concentration of hyaluronidase for a sufficient period of time in order to dissolve the HA obstruction to the point where the products of hydrolysis can pass through the capillary beds. He used the rough rule of thumb, using the lip, nose, and forehead as dose multipliers, with the standard dose of about 500 iu per area. For a single region, he recommend starting with a dose of about 500 iu every hour or so, until the ischemia is resolved (until skin color has returned and capillary refill time has returned to normal). For two areas, 1000 iu, and 1500 iu for three areas. Typically, most resolved in three or four treatments sessions, but rarely there have been up to 8 or 9 re-injections of hyaluronidase (De Lorenzi 2017).

As reported by Kim et al., it is not so infrequent to have a scarring outcome after skin necrosis. (Kim et al., 2011) He studied how hyaluronidase could be useful in the treatment of skin necrosis; performing injections on rabbits, he showed that hyaluronidase

reduced the vascular complications of HA fillers when used early, but there was no benefit in using hyaluronidase injection after 24 hour.

For this reason, skin necrosis, when occurs, should be treated immediately with hyaluronidase (in case of HA filler), warm compresses and nitroglycerine paste, and, in the case of bad wound outcomes, a surgical debridement and daily wound care are required to minimize scarring.

If symptoms of visual impairment occur, the goal is to reduce intraocular pressure and dislodge the embolus to improve perfusion of the retina and optic nerve. Especially in this case, it is mandatory to recognize immediately symptoms associated with vascular embolism of the ophthalmic artery and how to manage this complication.

Park et al. reported the outcomes of vascular embolism of the retinal artery after cosmetic filler injections into the glabellar region or nasolabial fold. Injected autologous fat and HA were associated with worse final best-corrected visual acuity than the other materials but the statistical data related to HA were probably due to the more frequent use of this kind of product. In his experience, all patients with ophthalmic artery occlusion had ocular pain and no improvement in best-corrected visual acuity after treatment (Park et al., 2012).

Even if the unfavorable outcomes in case of visual impairment after filler injections, the recommended measures include immediate ophthalmologic consultation, ocular massage, timolol eye drops, diuretics, hemodilution, corticosteroids, calcium channel blockers, anticoagulation, and needle decompression of the anterior chamber. For intravascular infarction after HA filler use, the minimum recommended injection of hyaluronidase is about 200–300 U of hyaluronidase (spread over the entire area of impending necrosis), repeated daily for a minimum of 2 days until signs of permanent necrosis or re-established blood flow appear. However, attempts to reverse retinal artery occlusion are often unsuccessful (Signorini et al., 2016).

## 4 | CONCLUSIONS

Even though soft-tissue fillers are generally safe, undesirable effects can occur with any type of filler. To prevent adverse events in nonsurgical rhinoplasty, a complete understanding of anatomy, injection plane, filler properties, and indications for use, and a complete medical history of the patients are mandatory. Proper precautions during nonsurgical rhinoplasty should be considered as syringe aspiration, use of cannula instead of needles, withdrawal technique, and slow speed of injection with small amount of product. In addition, patients should be always informed about all the risks associated with the cosmetic treatment proposed and should be monitored not also during the cosmetic procedure but after too.

Familiarity with the prevention, presentation, and immediate treatment of the adverse events is essential for attaining the best possible outcome.

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## DISCLOSURE OF INTERESTS

The authors whose names are listed above certify that they have no affiliations with, or involvement in, any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements) or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

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