Complications of dermal fillers

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Abstract
Facial rejuvenation is evolving rapidly and the use of injectable dermal fillers has been increasing. Although generally well tolerated, both short and long term complications can occur and can be serious. The main goal is to prevent them; however, this may not always be possible and good understanding of the management of complications is imperative for anyone performing the procedure.


Key words
Injectable, dermal fillers, complications, management

Introduction
The use of injectable dermal fillers, which can temporarily eliminate facial lines, rhytides and defects, has become increasingly popular with patients seeking facial rejuvenation. In recent years, the number of providers offering dermal fillers has rapidly increased owing to the relative ease and lucrative nature of the procedure. Although the procedure is minimally invasive and generally has a good safety profile, complications can arise.

Adverse effects of dermal fillers tend to be minor and localised; however severe complications can occur. Complications can be divided into early and late and range from bruising to necrosis.1,2 There are now over 60 dermal fillers available on the UK market and all have the potential to cause complications. They include hyaluronic acid (HA), poly-L-lactic acid, calcium hydroxylapatite and collagen fillers. Occasionally complications can be attributed to the selection of filler material, but in many circumstances can be related to incorrect technique and region selection. In order to provide safe care to patients and to achieve optimum outcomes, it is vital to have a full understanding of these issues.1,3

Complications: Early Onset
Early complications are those which occur within days to weeks of the initial injection.4 Minor complications in the early stage include bruising, swelling and discomfort.5 The use of local anaesthetic and recommendation of regular analgesia post procedure can reduce patient discomfort.5

Bruising
Bruising can occur within a few hours and may take several weeks to fully resolve. It is almost invariably minor; however, may be troublesome for the patient. Bruising is observed more frequently after injection into thin delicate skin, such as the lips and eyelids, and when into the dermal and subdermal planes.6 The popular fanning technique of injection has been reported to increase the risk of bruising.7 Steps can be taken to minimise the risk, including withholding medications known to thin the blood prior to the procedure such as aspirin, warfarin and non-steroidal anti-inflammatory drugs, as well as over the counter remedies such as St John’s Wort, ginseng and fish oil.6,8 Avoiding vigorous exercise for the first 24 hours to minimise hypertension, using fillers incorporating adrenaline (causing vasoconstriction), using the smallest gauge needle possible to deliver the filler and fewer injection sites, may all limit bruising.6 Generally, bruising is self-limiting and will resolve. Advising the patient to immediately apply pressure and a cold compress for fifteen minutes to the area post-procedure and using vitamin K cream may treat bruising. Rarely, persistent hemosiderin staining may require treatment with pulsed dye light or potassium titanyl phosphate lasers.6
Swelling
Temporary swelling immediately post-procedure is normal and common. Treatment and prevention is as for bruising, and should settle within a week. Oedema may be more significant when associated with hypersensitivity to the dermal filler, which may be an antibody-mediated or non-antibody mediated (delayed) reaction. Some patients may develop hypersensitivity on initial or repeated exposure to the filler agent due to an immunoglobulin E (IgE) mediated response, which results in swelling, pain, erythema and itching within hours of injection. Rapidly progressive angioedema is a medical emergency, but other patients may suffer angioedema that progresses more slowly but lasts several weeks and is not dangerous. For most, the swelling is short term and responds well to antihistamines. If antihistamines fail, oral prednisolone can be used. Chronic angioedema lasts more than 6 weeks and is challenging to treat and may require referral to immunology.

Delayed hypersensitivity reactions mediated by T-lymphocytes can occur between 24 hours to several weeks post-procedure. Antihistamines are of no benefit and treatment involves removal of the allergen. Hyaluronidase can be used for HA fillers. Other fillers may require treatment with oral prednisolone whilst the filler resorbs, followed by laser or extrusion if ongoing.

Importantly, malar oedema can occur following injection into the infraorbital hollow and tear troughs. Injection of filler into the superficial compartment of the superficial suborbicularis oculi fat can impede lymphatic drainage of the compartment (which already has poor drainage due to the malar septum) leading to fluid accumulation in the infraorbital region. Malar oedema is chronic and treatment resistant and therefore it has been recommended that injection into the infraorbital hollow is performed solely with HA, allowing for use of hyaluronidase if malar oedema is to occur.

Swelling following dermal filler injection may present similarly to other facial swellings and need careful assessment. Further investigations such as fine needle aspiration may be required to determine the nature of the swelling and surgical intervention may be required in some cases (Figure 1).

Infection
Infection can be an early complication and cellulitis can occur following injection of dermal fillers due to inoculation of bacteria into the skin or entry of microorganisms through the disrupted skin barrier. Cellulitis presents with skin erythema, warmth and oedema around the injection site. It is important to distinguish this from hypersensitivity reaction which also causes erythema, but there is also usually an itch and the patient is apyrexial. Abscess formation is rare but requires treatment with antibiotics, incision and drainage. Unlike granulomas which shall be discussed later, abscesses are fluctuant with notable tenderness and warmth. Antibiotics covering Staphylococcus and Streptococcus are the treatment of choice and may need to be given intravenously if the patient is systemically unwell or immunosuppressed. Periorbital and midfacial infection require prompt treatment due to the risk of intracerebral spread.

It is important to check for any history of cold sores as injections in the perioral region can lead to reactivation of the herpes virus. It has been suggested that a prophylactic course of aciclovir may be of benefit for those with a history of the virus. If infection does occur, aciclovir can be used if infection is recognised early and in combination with antibiotics if there is superimposed bacterial infection.

Implant visibility
Other early complications include under and overcorrection and implant visibility. Knowledge of the unique characteristics and mechanism of action of each dermal filler agent, in addition to correct technique, is crucial in placing the right amount of filler at the correct skin depth in order to avoid filler visibility or nodularity. Injecting a filler agent too superficially can result in implant visibility. Intervention is required in these events. Firm massage can be used to disperse excess HA or hyaluronidase can be injected. For other particulate dermal filler materials such as calcium hydroxylapatite or polymethylmethacrylate,
excess may need to be removed using dermabrasion or unroofing with a needle.³

Vascular compromise and necrosis
Skin necrosis following filler injection is a much feared complication. Necrosis is caused by vascular compromise resulting from obstruction of arterial or venous blood supply. The blood supply may be interrupted by inadvertent intravascular injection into an artery and embolisation, trauma to the blood vessel wall, or from external pressure of the filler onto the vessel wall causing compression.⁹,¹⁰ Not only can vascular compromise result in skin loss and scarring, reports of acute blindness, stroke and death are made in the literature as a result of ocular and cerebral embolism.⁶,¹¹-¹⁵ The glabella is suggested to be the site at greatest risk of necrosis, but the nasolabial fold also carries a risk.⁷ Recognition of vascular compromise and immediate treatment is vital in order to avoid serious adverse effects. Those performing dermal filler injections should also have a sound understanding of the anatomy of the vasculature surrounding the injection sites.

There are several factors which increase the risk of vascular compromise and those performing dermal filler injections can take measures to minimise them by doing the following:

1. Aspirating prior to injection to ensure the needle tip is not within a vessel.¹⁶,¹⁷
2. Avoid overcorrection and minimise the amount of filler volume used.¹⁶
3. Injecting at a low pressure.¹⁷
4. Avoiding deep injection of the filler product (larger blood vessels are located deep to the dermis).⁶
5. Use a blunt needle of the smallest size (blunt tip separates key structures including vessels rather than puncturing them, as with a sharp tip).¹⁸
6. Using a temporary product such as HA which has the option of hyaluronidase to quickly resorb some of the product.¹⁸,¹⁹ Avoid the use of autologous fat injections which are highlighted in the literature as being associated with embolisation and visual loss.⁶,¹²,¹³
7. Avoiding scarred tissue areas (scars may fix vessels and make direction injection into the vessel easier).²⁰
8. The glabella region should be reserved for those more experienced.⁸

The classical signs of impending vascular compromise are immediate-onset skin changes, with blanching, violaceous, or mottled appearance, and severe pain that is inconsistent with that typical of the injection.⁶,⁹ There is also the possibility of delayed-type necrosis with symptoms occurring several hours after injection.¹⁷ Swift recognition of vascular compromise and urgent intervention can potentially prevent progression to necrosis, and therefore if suspected, the injection should be stopped immediately. Aspiration of the filler can be attempted before taking steps to improve blood flow.⁹ This includes massaging the area, application of warm compresses, as well as 2% nitroglycerin to promote vasodilatation.⁶,⁹ The topical nitroglycerin paste can be applied every one to two hours initially.¹¹ Hyaluronidase should be injected into the site HA fillers, and some suggest the use of hyaluronidase regardless of the filler used.⁶ A course of aspirin to prevent further clot formation has been suggested, as well as low molecular weight heparin for more severe cases. The use of hyperbaric oxygen therapy may be helpful in patients with impending extensive skin necrosis.¹¹

Once necrosis has occurred, good wound care with daily dressing changes are important to minimise scarring, as are antibiotics for any superadded skin infection. Antivirals should be considered if necrosis occurs around the mouth. Intraliesional steroid injections, light dermabrasion and surgical revision may be considered for persistent scarring.¹¹

The patient should be made aware of the risk of visual impairment and blindness. Direct injection of filler material into one of the distal branches of the ophthalmic artery (dorsal nasal, angular artery, zygomaticotemporal, zygomaticofacial, supratrochlear and supraorbital arteries) can lead to retinal artery occlusion.²¹-²³ Urgent referral to an ophthalmologist is needed if there are any concerns regarding vision following injection.

Complications: Late Onset
Late complications occur weeks to years after injection and comprise chronic inflammation and infection, nodules and granulomas, filler migration and scarring.²⁴

Migration
Soft tissue fillers may migrate to a location away from their site of injection and may occur some years post-injection.⁷,²⁵ It can lead to mass lesions and swellings in other areas, including a ‘popcorn lip’ and patient dissatisfaction.⁷ It can also result in inadvertent compression of other structures (Figure 2). Migration is more commonly associated with permanent and semipermanent fillers, such as calcium hydroxylapatite and silicone, rather than temporary fillers, which are reabsorbed before migration can occur.⁷ However, cases of migration with temporary fillers such as HA are reported.²⁵ It may occur due to poor technique; large volumes injected
under high pressure for example, and may be triggered by chronic inflammation or granuloma formation. Treatment options may include resorption with hyaluronidase or surgical removal.26

Nodules
Subcutaneous nodules are a known complication of dermal filler injections and usually trouble the patient. They may be non-inflammatory or inflammatory, and present as lumps weeks to months following treatment.6

Non-inflammatory nodules tend to be painless and palpable lumps that do not grow in size. They are usually localised to the injection site, but it is possible for the nodules to migrate.9 Localised accumulation of filler is the most common cause of non-inflammatory nodules which may be due to overcorrection, injection of the filler too superficially or failure to discontinue the injection prior to removal of the needle.8 Fillers such as HA, calcium hydroxylapatite and poly-L-lactic acid require injection mid dermis or deeper and nodules will form if injected superficial to this.7 Whilst it may seem that a deeper injection is better, it is important to consider that the risk of vascular compromise will increase and the augmentation effect may not be as evident.7

Appropriate depth of HA injection is also important to avoid the complication referred to as the ‘tyndall effect’ which describes a bluish discolouration of the skin due to too superficial placement of the filler.27 It occurs because of the light-scattering capacity of the filler material and is more likely to occur in areas with thin skin such as periorally and tear troughs.28 It may be mistaken for a bruise, but does not resolve within a few days unlike bruising. Careful skin assessment pre-procedure and avoidance of areas of thin skin is important to prevent discolouration, and firm massage, aspiration and hyaluronidase injections can be used for treatment.27

Non-inflammatory nodules occurring after HA injection usually resolve with hyaluronidase. Those that form following injection with other filler types can be treated with massage in combination, with or without, either lidocaine or normal saline, before a trial of intralesional steroid injections. Further treatment options include injections of 5-fluorouracil (5-FU) and surgical excision as a last resort.6

Non-inflammatory nodules should be distinguished from granulomas and biofilms, which occur as a result of inflammation around the foreign-body filler material and can be differentiated from a non-inflammatory nodule by tenderness, swelling, possible erythema and expression of pus.9 Granulomas typically appear later than non-inflammatory nodules (several months to years as opposed to several weeks) and form in an attempt to contain any foreign material by enclosing it in a capsule of immune cells such as macrophages.6 Intralesional corticosteroid injections remain the mainstay of granuloma treatment. Other therapies such as intralesional injections of 5-FU and hyaluronidase for HA fillers may be helpful, and surgical excision is required if other therapies fail.6

A biofilm is an accumulation of microorganisms that are either associated with a surface, such as a foreign implant, or attached to one another and form a living colony.9 They typically present as chronic and recurrent infections at the injection site and although antibiotics may provide some temporary relief, usually definitive treatment is with removal of the filler and its biofilm.9

Although most complications including infection are not specific to a particular dermal filler, polyacrylamide gel (PAAG) is particularly biocompatible and provides bacteria an excellent material on which to multiply.10 This can lead to late infections, abscesses and biofilms. If not
responsive to conventional antibiotic treatment, it is imperative to consider infection with atypical species.\textsuperscript{10}

**Conclusions**

Dermal fillers are becoming increasingly popular. Clinicians should be fully aware of the signs and symptoms of complications and how to avoid them as much as possible. Adverse effects may occur early and appear to be minor but may still be concerning for the patient. Serious complications such as skin necrosis can be life-changing and even life-threatening. Good anatomical knowledge and proper technique can help to reduce the risk of complication, and when a complication does occur, the clinician should understand how to manage them from observation to surgical intervention.

**References**

1) Halepas S, Peters SM, Goldsmith JL, Ferneini EM. Vascular observation to surgical intervention. Clinician should understand how to manage them from complication, and when a complication does occur, the possible. Adverse effects may occur early and appear to be minor but may still be concerning for the patient. Serious complications such as skin necrosis can be life-changing and even life-threatening. Good anatomical knowledge and proper technique can help to reduce the risk of complication, and when a complication does occur, the clinician should understand how to manage them from observation to surgical intervention.

References


