



Management of Necrosis

Seriousness of complication		Frequency of complication	
Minor complication		Common	
Worrying complication		Occasional	
Moderate complication		Infrequent	
Serious, but not major		Rare	X
Major complication	X	Very rare	

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Management of Necrosis

Definition:

"The death of most or all of the cells in an organ or tissue due to disease, injury, or failure of the blood supply."¹

Unlike normal cell death, which is a programmed and ordered phenomenon, necrosis is the accidental death of the cell caused by various mechanisms such as an insufficient supply of oxygen, thermal or mechanical trauma or irradiation. Cells that are undergoing necrosis swell and then burst (cytolysis), releasing their contents into the surrounding area. This results in a locally triggered inflammatory reaction characterised by swelling, pain, heat and redness. The necrotic cells are subsequently phagocytosed and removed by the immune system.

Introduction:

"Necrosis is one of the most severe and feared early occurring complications in aesthetic treatments and may be due to:"²

- 1) Interruption of the vascular supply
- 2) Compression of the area around a vessel
- 3) Obstruction of a vessel with foreign material
- 4) Direct tissue damage due to physical, chemical, radiation or laser properties

Incidence:

Although necrosis may occur as a result of many aesthetic treatments, it is most commonly associated with the injection of dermal fillers. The incidence of necrosis related to the injection of collagen has been reported at 9 in 100,000 cases of which 50% of cases were in the glabellar region³ and for all dermal fillers an incidence of 1 in 100,000 cases⁴. Necrosis has occurred as a result of injection of all types of dermal filler including collagen, hyaluronic acid, calcium hydroxylapatite, PMMA (Polymethylmethacrylate beads) and fat⁵.

Signs and symptoms of necrosis:

Many cases of impending necrosis occur immediately with injection and the practitioner needs to be aware of the signs of this. However there are several published papers describing delayed necrosis^{5,6}. This is thought to be due to the hydrophilic properties of hyaluronic acid fillers causing increased swelling post-treatment and a subsequent compression of a vessel. There is also some evidence that delayed necrosis may be due to intra-arterial injection leading to embolism and a subsequent nidus for platelet aggregation with subsequent occlusion in a terminal branch.

1) Pain^{2,3,5,6,7}

Severe pain is usually experienced by the patient when necrosis ensues, although if local anaesthetic has been used (either topically, a nerve block or administered with the product) this symptom may be lessened.

Remember: Severe pain is not a feature of dermal filler treatments and if a patient complains of severe pain during treatment or in the subsequent hours after treatment, this should alert the practitioner to the risk of impending necrosis and warrant an urgent review.

2) Prolonged blanching^{2,3,5,7}

When the vasculature is affected, the area will often initially look very pale, white or dusky due to the reduction in blood supply. This colour will remain after removal of the needle. The pattern of the blanching is often described as reticulated or irregular, following the same path as the blood supply that has been restricted. This blanching may not be apparent if adrenaline or certain topical anaesthetics have been used^{6,7}.

3) Dusky, purple discolouration^{5,7}

This is more typical several hours later following treatment when tissue death has already occurred.

4) Coolness⁷

When the blood supply has been affected, the tissues are not being perfused so the temperature will be reduced, this will not be apparent immediately following injection.

Areas of caution:

There are two main areas on the face that are vulnerable to necrosis following injection of dermal fillers:

1) Glabellar region

50% of cases of necrosis occur as a result of injection of dermal fillers in the glabellar region due to the poor collateral circulation in this watershed area^{2,3,4,8}.

2) Nasal tip and alar triangle

The nasal tip and alar are also commonly affected due to these being supplied by an end artery with no collateral blood flow. The angular artery turns sharply within the alar triangle and is prone to external compression or inadvertent injection leading to necrosis^{3,4,7}.

Minimising the risk of necrosis:

- 1) Having a good knowledge of the anatomy of the area being treated^{7,9}.
- 2) Aspiration prior to injection to try and ascertain that the injection is not intravascular, although beware as aspiration may not always be possible even if the needle tip is within a vessel^{5,7,8,10}.
- 3) Good injection technique with the filler delivered at the appropriate depth and tissue plane^{2,5}.
- 4) The smallest possible volume to achieve the desired effect should be used, avoid overfilling an area and if more product is required, a repeat treatment in 7-14 days may be more appropriate and safe^{2,7,8}.
- 5) Avoid bolus injections in areas at risk of necrosis⁷.
- 6) Avoid using products containing adrenaline as this may mask the blanching produced by occlusion⁶.
- 7) Injection of local anaesthetic or lidocaine pre-mixed with a dermal filler may lessen or block any pain experienced by the patient of an impending necrosis and the practitioner may lose an important warning sign.
- 8) Do not inject into the tip of the nose.
- 9) Use caution when injecting into the glabellar region² and injections should be placed superficially and medially⁸.
- 10) The use of blunt ended cannulas are less likely to penetrate vessels and lead to an inadvertent intravascular injection⁷.
- 11) Patient selection is paramount, be cautious when treating patients who have undergone rhinoplasty³ or other surgical procedures as the anatomy and vasculature may be altered. Extra caution is required when injecting over existing fillers.
- 12) Pay attention when injecting – look for warning signs and listen to your patient!
- 13) Necrosis is more common when using denser or longer-acting/permanent fillers.

Treatment of necrosis:

Necrosis may result from arterial occlusion by direct injection into an artery or embolization of product, typically presenting immediately with acute pain and blanching. It may also occur due to venous occlusion from external compression of a vessel by dermal filler or subsequent oedema and compression, more often with hyaluronic acid fillers. Venous occlusion usually presents later with dull pain and dark discoloration of the skin².

1. Immediately stop treatment^{2,3,4,5,6,8,9}

As soon as the practitioner suspects the blood supply has been compromised (typically pain and blanching in an at risk area), the most important step is to immediately discontinue injecting any further product and if possible aspirate any product when withdrawing the needle.

2. Massage the area^{2,3,4,5,6,8,11}

Massage will help to encourage blood flow and may remove any obstruction caused by dermal filler compressing a vessel. Massage may be required for several minutes.

3. Apply heat^{2,3,4,5,6,8,9,10,11}

Heat will encourage vasodilatation and increase blood flow to an area.

4. Tap the area¹⁰

Tapping over an area may dislodge intra-arterial emboli either at the site or further up in the vessel.

5. Inject with hyaluronidase^{2,3,4,5,9,10,11}

Where hyaluronic acid fillers are the culprit, injecting with hyaluronidase may relieve the problem before complications even occur (Refer to the Aesthetic Complications Expert Group document on Hyaluronidase). Test patching is not required if hyaluronidase is used for impending necrosis as the risk of necrosis is generally greater than the risk of anaphylaxis. As with any aesthetic treatments, it is important to have appropriate resuscitation available to deal with any potential complication⁷. There is some evidence to suggest that using hyaluronidase when a non-hyaluronic acid dermal filler has been injected may lessen the subsequent necrosis⁴.

A study conducted by Deok-Woo Kim et al¹¹ demonstrated significantly reduced areas of necrosis when hyaluronidase was administered within 4 hours of a hyaluronic acid dermal filler injected into the auricular arteries of rabbits, however no improvements were shown after 24 hours.

Hyaluronidase has also been shown to diffuse into the lumen of blood vessels even when injected external to it so for potential cases of necrosis due to intravascular deposition of hyaluronic acid, it is not essential to inject directly into the vessel but the surrounding area is also likely to result in dissolution of the product.

6. Apply nitroglycerin paste^{2,3,4,5,6,8,10,11,12}

Nitroglycerin (glyceryl trinitrate) induces vasodilatation and increases blood flow to the area. Nitroglycerin paste (Rectogesic, used off label) is applied under an occlusive dressing and used for several days, it is recommend applying for 12 hours and then removing for 12 hours until clinical improvement is seen⁸ or until it is no longer tolerated. Nitroglycerin can lead to skin reactions, irritation and erythema.

7. Aspirin⁷

One article encouraged the use of aspirin until the necrosis had resolved, this would be to limit platelet aggregation, clot formation and further compromise where a blood vessel has already been impeded. The case study recommended immediate treatment with two 325mg enteric coated aspirin⁷. However the evidence for the use of aspirin in cardiovascular disease which follows a similar mechanism of action recommends a stat

dose of 300mg followed by 75mg a day until the necrosis has resolved and where there are no contra-indications to the use of aspirin¹³.

8. Antibiotics^{2,3}

Necrosis consists of dead cells and dead tissue and is prone to secondary opportunistic infection. Depending on the extent of necrosis, topical and/or oral antibiotics may be required to promote healing and to prevent further complications developing.

Anti-herpetic medication may be advised if necrosis occurs in a susceptible patient in a perioral distribution⁴.

9. Superficial debridement^{2,3,5,8,9}

Referral to a plastic surgeon may be required for removal of dead tissue to promote healing.

10. Wound care management^{3,8}

Appropriate dressings and wound care to encourage healing.

11. Refer

It is always sensible to involve other practitioners experienced in the management of necrosis for further advice and/or treatment.

12. Speak to your medical defence organisation

Necrosis can cause quite significant scarring and distress to patients and is likely to result in a claim against the practitioner.

Hyperbaric oxygen therapy has been successfully used in nasal tip grafting following cases of cancer or trauma with positive results on revascularisation although there is not enough evidence to recommend this for necrosis secondary to aesthetic procedures^{2,3,14}.

The use of low molecular weight heparin⁴ has been used to prevent thrombosis and embolisation in one case report¹⁵ although there is not enough evidence to recommend this as a standard treatment. Oral vasodilators including PDE5 (cGMP-specific phosphodiesterase type 5) inhibitors have also been advised for the treatment of necrosis but evidence is lacking for their wider use for this indication⁴.

Pain management needs considering in cases of necrosis as although over the counter medication may be all that is required, necrosis can cause severe pain requiring opioid analgesia.

Follow-up:

All patients presenting with necrosis need follow up until the problem has completely resolved, this may be on a day by day basis initially. Immediate follow up is required when a patient contacts the practitioner and a delayed onset of necrosis is suspected. The Aesthetic Complications Expert Group advocates an emergency telephone number where the practitioner can be contacted out of office hours.

Good follow up and client support and full explanations to the client is the best approach to stop a complication turning into a medical malpractice claim!

Necrosis caused by sclerotherapy¹⁶:

The incidence of necrosis following the injection of sclerosant when treating veins is 1 in 100-500 cases¹⁷ which is a considerably greater frequency than caused by dermal filler treatments. Necrosis may be mild and result in a small area of ulceration with complete healing without scarring or it may be severe resulting in significant tissue death. Necrosis may occur due to the inadvertent injection of sclerosant into an artery or arteriole or due to excessive injection pressure leading to retrograde flow of sclerosant into the arterial-capillary vasculature (low volume and low pressure desirable). The sclerosant used may have an impact on the incidence of necrosis (certain sclerosants have greater inherent risk such as hypertonic saline but also the concentration of products for the size of the vein also needs consideration) and certain patients are at a higher risk (such as smokers or if there is an underlying vasculitis).

The presentation is similar to what has previously been described and key features include pain, pale skin and discolouration within the first 24 hours after treatment has taken place. Dermal sloughing occurs within 24 to 72 hours after the ischaemic event and an ulcer often subsequently develops.

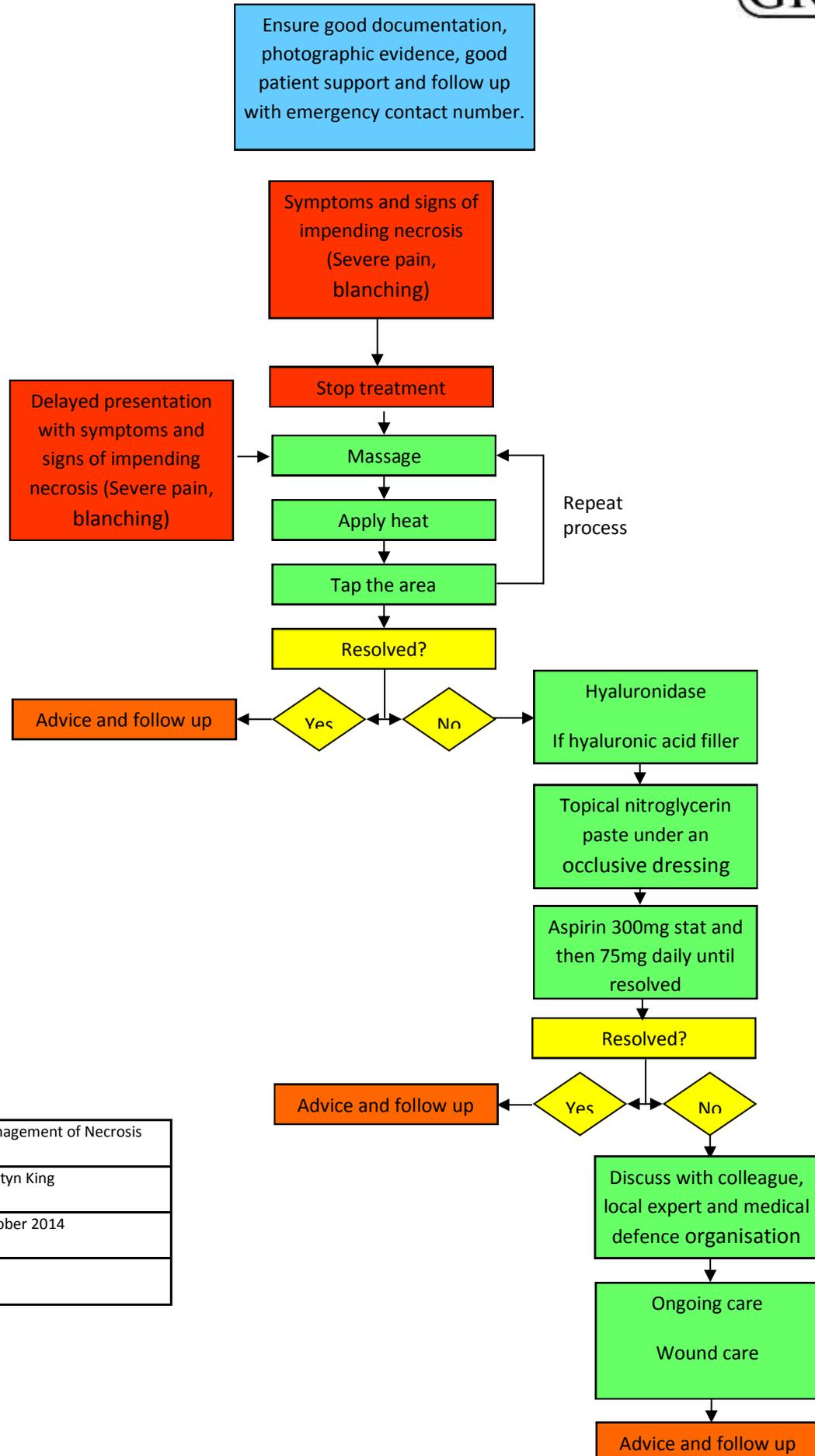
Treatment is supportive and includes measures to try and improve perfusion to the area, compression and occlusive dressings. If wound infection occurs then antibiotics may be required. Appropriate wound management including superficial debridement may also be needed. Once the area has healed, dermal scarring should be addressed.

Prognosis is very good when the extent of necrosis is minimal.

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