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ORIGINAL ARTICLE

# Management strategies for vascular complications in hyaluronic acid filler injections: A case series analysis

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## Abstract

**Background:** As hyaluronic acid (HA) filler injections have become increasingly popular in the esthetic field, so have their side effects. Vascular complications, which can lead to skin necrosis or permanent scarring, are a particularly dangerous complication and occur when the filler is injected directly into a blood vessel or when an adjacent blood vessel is compressed by the filler material.

**Objective:** To assess the clinical prognosis based on post-procedural management and clinical findings of HA filler vascular complications.

**Methods:** Herein, we present a case series of vascular complications due to HA filler and evaluate their clinical prognosis based on post-procedural management and clinical findings. Clinical assessments were performed using Doppler ultrasound, thermography, and laboratory tests.

**Results:** Factors including white blood cell count, the time of treatment initiation, and time of hyaluronidase injection influenced the clinical outcomes. Early recognition and prompt hyaluronidase injection proved crucial in preventing further damage and improving prognosis.

**Conclusion:** This case series highlights the importance of early detection and appropriate management of HA filler complications. Physicians should be aware of the potential risks associated with fillers and promptly address any adverse effects to achieve optimal clinical outcomes. Further studies are warranted to confirm these findings and refine treatment strategies for the HA filler complications.

KEYWORDS
dermal fillers, hyaluronic acid, prognosis, vascular complication

## 1 | INTRODUCTION

Hyaluronic acid (HA) fillers are a popular cosmetic treatment used to reduce the appearance of wrinkles, restore facial volume, and enhance facial features. While generally considered safe, there are potential complications associated with their use including bruising, swelling, redness, and asymmetry. In some cases, serious complications can occur, such as infection, allergic reactions, and vascular occlusion, which can lead to tissue necrosis or blindness.[1]

The clinical outcomes and prognostic factors of HA complications depend on the nature and severity of the adverse effects. For minor complications such as bruising and swelling, the prognosis is

typically good, and the symptoms usually resolve within a few days to a few weeks. However, more severe complications such as tissue necrosis or blindness can have long-lasting effects and may require immediate medical intervention to minimize the damage. In some cases, these complications may be irreversible and could result in permanent disfigurement or vision loss. Other factors that can affect the prognosis of HA filler complications include the patient's age, overall health, and any pre-existing medical conditions.[2,3]

It is essential to seek medical attention promptly if a patient experiences any complications following HA filler injections to ensure the best possible clinical outcome. In this study, we reported HA filler complication cases to assess their clinical prognosis based on post-procedural management and clinical findings.

## 2 | CASE REPORTS

### 2.1 | Case 1

A 28-year-old female presented with diffuse erythematous patches on the left cheek, nose, and nasolabial fold (NLF). The patient had been injected with HA filler in both NLFs 1 day previously. There were blanching changes and pain in the left side of the face immediately after injection; therefore, a physician injected 1500 units of hyaluronidase into the injected site to resolve the filler materials. The patient was transferred to our hospital 1 day after the injection.

To identify complications due to vaso-occlusion, a Doppler ultrasound examination and thermography examination were done. Ultrasound examination showed increasing vascular components on the left side of the face and thermography showed a higher skin temperature on the left side. The white blood cell (WBC) count increased to $9.25\times10^9$/L and other markers of inflammation such as the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were normal.

The patient received sublingual nitroglycerin 0.6 mg and low-dose aspirin 100 mg daily and 200 mg cefpodoxime, a prophylactic antibiotic, for 1 week. This increased blood flow and prevented further dot formation. Hyperbaric oxygen therapy, saline soaking, gentle pustule extraction using smooth forceps, and 830 nm LED therapy (intensity 8, duration 6 min) were performed. Skin lesions were covered with Vaseline petrolatum gauze and Terramycin Eye Ointment (oxytetracycline hydrochloride 5 mg/1 g and polymyxin B sulfate 1000 IU/1 g) and Easyef Ointment (human epithelial growth factor (EGF) 1 μg/5 g) twice daily were applied until the reticular patches began to disappear and no new pustules were observed. The lesion had been worsening with new pustules and reticular patches for 3 days after the injection. It took about 1 week to resolve completely and resulted in no residual scarring at the 2-month follow-up visit.

### 2.2 | Case 2

A 52-year-old female presented with diffuse violaceous patches on the nasal dorsum, ala, and cheeks. HA filler had been injected into both NLFs 5 days previously. Immediately after the injection, the patient felt pain and had erythema on the left side of the nose and cheek. A physician injected 1500 units of hyaluronidase and applied dressings on post-procedure Day 4. The lesion did not show much improvement, so she was eventually referred to our hospital (Figure 1A).

Doppler ultrasound examination showed a hypoechoic pseudocyst composed of HA filler and no obstruction signs of vessels around the lesion. Thermography showed a lower superficial temperature at the skin lesion (Figure 3A,B). WBC counts increased to $9.98\times10^9$/L and the ESR and CRP were normal.

A systemic antibiotic (cefazolin) was administered intravenously. She was treated with cefpodoxime 200 mg, low-dose aspirin 100 mg, and sublingual nitroglycerin 0.6 mg for 3 weeks until the erythema improved and all eschars were removed, along with daily saline soaking, 833-nm LED irradiation, and Vaseline gauze dressings with topical tetracycline. A depressed hyperpigmented scar and asymmetric nostril were still notable at the 2-month follow-up visit (Figure 1B).

### 2.3 | Case 3

A 33-year-old female patient was referred to our clinic with a black, thick-crusted plaque, and erythematous swelling with purulent discharge on the nasal tip and left NLF (Figure 1C). She had received HA filler injection into the NLFs 8 days before presentation. She reported having pain, bleaching, and numbness after the injection. She received two hyaluronidase injections into the lesion on Days 1 and 2 after the injection.

She was admitted to our hospital and systemic antibiotics (cefazolin and ciprofloxacin) were administered intravenously. The WBC count increased to $14.37\times10^9$/L, the ESR increased to 50 mm/h, and CRP increased to 22.8 mg/L. A Doppler ultrasonography test showed an increasing vascular component on the left side NLF (Figure 3C,D). A thermography exam demonstrated a higher temperature on the left NLF.

She was treated with low-dose aspirin, sublingual nitroglycerin for 4 weeks, an occlusive dressing with Vaseline gauze, tetracycline, and topical EGF ointment after gentle pustule extraction, and LED irradiation two times daily for 3 weeks. Although the skin lesion had improved, mild erythema and a depressed scar with an asymmetric nostril remained until the follow-up visit 4 months later (Figure 1D).

### 2.4 | Case 4

A 28-year-old female came to our clinic with eroded reticular violaceous patches and pain in the left nasal alar (Figure 1E). She had received an HA filler injection into the nasal tip 2 days before presentation. 1500 units of hyaluronidase was injected the next day; however, the pain had worsened.

A Doppler ultrasound examination showed intact lateral nasal arteries and thermography showed a lower superficial temperature

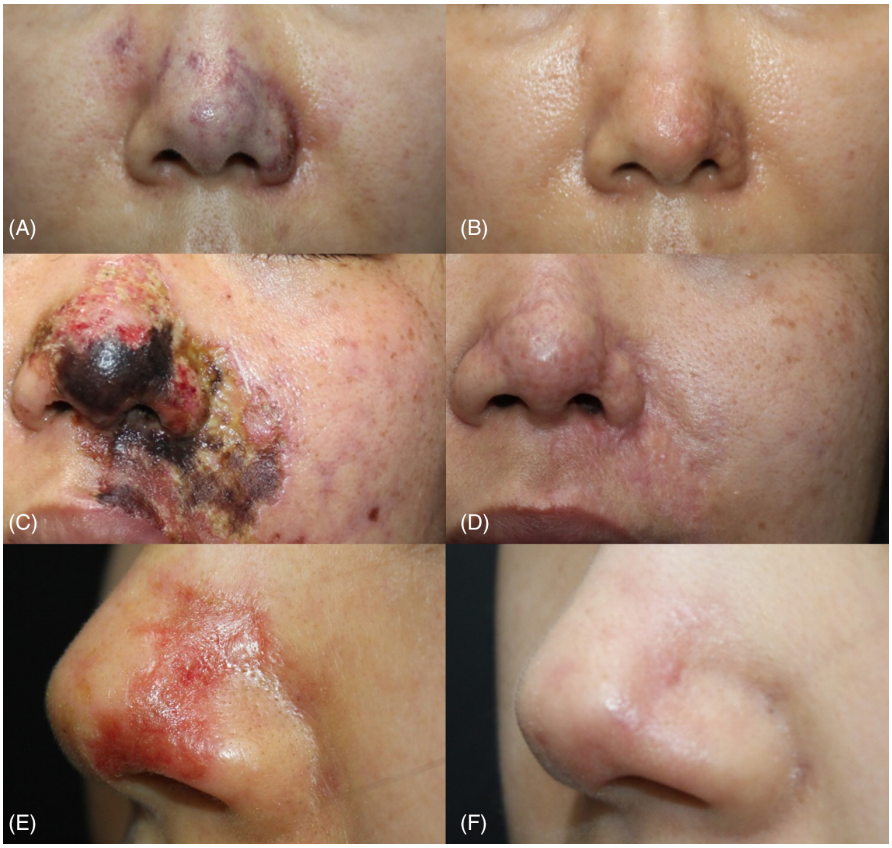


**FIGURE 1** Clinical photographs of Cases 2–4. (A) Diffuse violaceous patches on the nasal dorsum, ala, and right cheek of Case 2. (B) Asymmetric nostril with depressed hyperpigmented scar after 2 months. (C) A black, thick-crusted plaque and erythematous swelling with purulent discharge on the nasal tip and left nasolabial fold of Case 3. (D) Persistent erythema and depressed scar with asymmetric nostril after 4 months. (E) Painful eroded reticular violaceous patches on the left nasal alar of Case 4. (F) Complete resolution without scar after 1 month.

at the nasal tip. The WBC count increased to $12.18\times10^9$/L and the ESR and CRP were normal.

The patient received sublingual nitroglycerin 0.6 mg and low-dose aspirin 100 mg daily and cefpodoxime 200 mg for 2 weeks. She also received hyperbaric oxygen therapy, saline soaking, gentle pustule extraction using smooth forceps, 830 nm LED therapy, and the lesion was covered with Vaseline gauze with topical tetracycline once daily until no new pustules appeared. After 1 week, it had resolved completely resulting in mild pigmentation at the 1-month follow-up visit (Figure 1F).

## 2.5 | Case 5

A 31-year-old female presented with violaceous reticular patches and erythematous swelling on the nose, glabella, and forehead after being injected with HA filler into her nose 3 days previously (Figure 2A). After the injection, she complained of pain and skin color change at the injection site. Hyaluronidase was injected immediately into the lesion to resolve the HA filler materials.

A Doppler ultrasound examination showed a hypoechoic cyst estimating HA filler with normal vessel patterns on both sides (Figure 3E). The WBC count increased to $9.84\times10^9$/L and inflammatory markers were in the normal range.

Sublingual nitroglycerin 0.6 mg, low-dose aspirin 100 mg daily, and cefpodoxime 200 mg were prescribed for 1 week. Hyperbaric oxygen therapy, saline soaking, gentle pustule extraction, and 830 nm LED therapy were performed with a Vaseline gauze applying topical tetracycline and human EGF once daily until the erythematous patches and pustules began to disappear. Although new pustules appeared after a few days (Figure 2B), the skin lesion had improved with a mild scar and hyperpigmentation at the 3-month follow-up visit (Figure 2C).

## 2.6 | Case 6

A 35-year-old female patient was referred to our clinic with multiple grouped pustules and erythematous reticular patches on the left nasal alar and NLF (Figure 2D). She had an HA filler injection into the NLFs 2 days prior. She complained of pain immediately after the injection and an erythematous patch appeared 2 days after the injection. She received hyaluronidase injections (1500 units) just after the erythema appeared.

She was admitted to our hospital and systemic antibiotics (cefazolin and ciprofloxacin) were administered intravenously. The WBC count increased to $10.76\times10^9$/L, the ESR increased to 23 mm/h, and the CRP increased to 7.4 mg/L. A Doppler ultrasonography test showed an increasing vascular component on the left side of the NLF and nasal alar. A thermography exam showed a higher temperature on the left side of the nose. She was treated with low-dose aspirin, sublingual nitroglycerin, occlusive dressing with Vaseline gauze, tetracycline after gentle pustule extraction, and LED irradiation three times daily for 1 week. The skin lesion had improved but mild erythema remained 5 days later (Figure 2E).

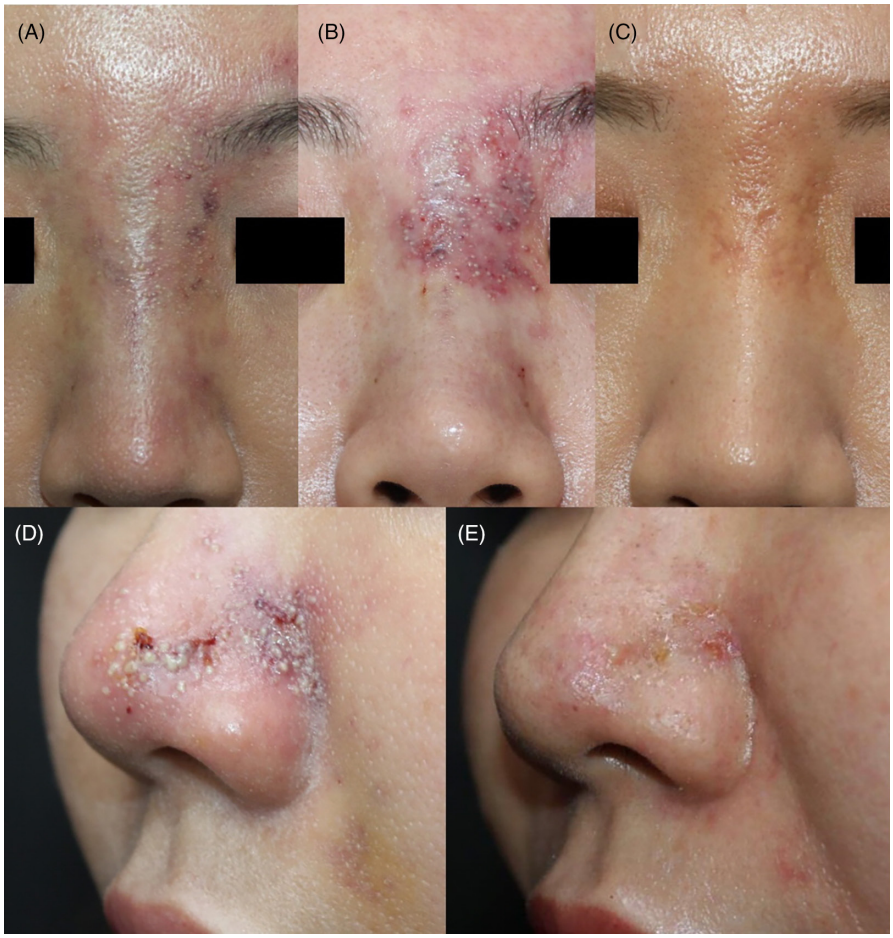


**FIGURE 2** Clinical photographs of Cases 5 and 6. (A) Violaceous reticular patches with swelling on the glabella and forehead of Case 5. (B) Multiple pustules appeared on the erythematous patches after several days. (C) Improved skin lesions with mild scar and hyperpigmentation after 3 months. (D) Multiple grouped pustules and erythematous reticular patches on the left nasal ala and nasolabial fold of Case 6. (E) Mild erythema without scar after 5 days.

## 3 | DISCUSSION

Fillers are mainly used for cosmetic purposes to compensate for skin wrinkles, thin lips, facial volume deficit, and scars. However, complications and adverse effects may occur when using fillers. Mild and transient adverse effects include erythema, bruising, foreign body sensation, pain, and inflammation. However, serious adverse effects may also occur in relation to filler injection including infection, adhesion, tissue degeneration, and skin necrosis.[4,5] One of the side effects that practitioners should pay the most attention to are vascular complications where blood vessels are damaged during filler injection, which interferes with blood circulation due to external vessel compression or the obstruction of blood vessels. In these cases, filler-induced tissue necrosis may occur unpredictably, and depending on the degree of vascular damage, the degree of necrosis may be extensive or irreversible.[6,7]

To minimize cosmetic and functional damage caused by fillers, it is very important to detect vascular complications at an early stage and start proper treatment. Typical early clinical findings related to filler-induced vascular complications are skin blanching and reticulated patterned or dusky blue-red skin discoloration. These subjective symptoms are mainly accompanied by swelling and pain. Within a few days, skin lesions gradually turn into crusts and eschar after blisters and pustules occur. To avoid any irreversible change, immediate aggressive treatment should be applied to encourage vasodilation and restore blood supply to the area of blanching. If there are any signs of vascular complications, practitioners should discontinue injections immediately and apply gentle massage to the affected area and warm compresses. Aggressive treatment should be initiated immediately to restore blood supply, such as vasodilators including sublingual or topical nitroglycerine, gentle massage, warm compresses, and hyaluronidase injection. Proper wound management with saline soaking, topical ointment, and dressing is also essential.[8–10]

In the case series reported here, most patients developed complications around the cheek, nose, and NLF after HA filler treatment to the NLF (Table 1). We also included cases that occurred after the injection of HA fillers into the nasal tip, glabella, and forehead. When treating patients with HA filler side effects, we performed laboratory tests, thermography, and ultrasonography, and based on these, we tried to assess which factors would affect the clinical outcomes and prognosis of HA filler complications. In all cases of filler complications, there was a slight increase in WBC levels in blood tests. In one case, the WBC levels were significantly elevated, along with other inflammatory markers including the WBC and ESR. This case was accompanied by extensive necrotic tissue and eschar. In relation to thermography, when there is no localized increase in skin temperature at the site of the occurrence of filler complications, it indicates the absence of severe acute inflammation such as pustules and crusts. When the localized skin temperature increases on thermography, it is accompanied by

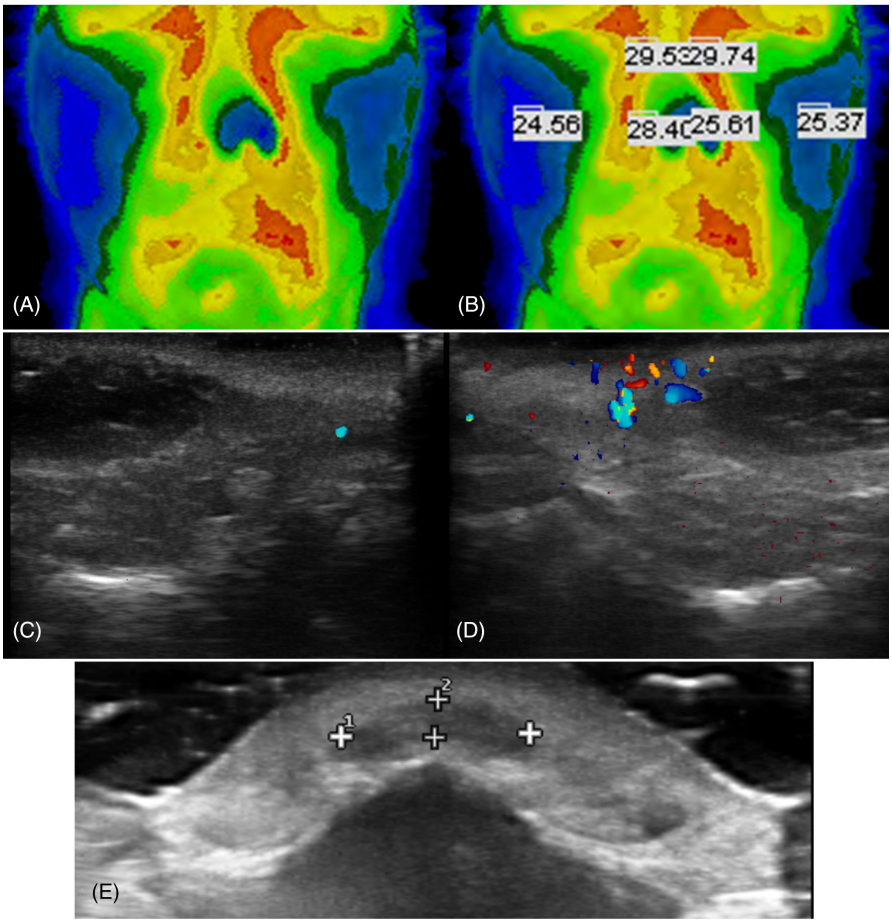


**FIGURE 3** Doppler ultrasonography and thermography images of the cases. (A, B) Superficial temperature of nasal alar is lower in the left HA injected side than in the right side (Case 2, thermography). (C, D) Increased vascular components on the left nasolabial fold (Case 3, Doppler ultrasonography). (E) Hypoechoic cyst estimating injected HA filler with normal vessel pattern (Case 5, Doppler ultrasonography).

local inflammatory lesions such as pustules and crusts. In some cases, increased vascular components were observed by Doppler ultrasound, and in this case, an increase in skin temperature was also demonstrated by thermography.

Doppler ultrasound is a non-invasive imaging technique that uses sound waves to evaluate blood flow and detect vascular abnormalities. Neovascularization refers to the formation of new blood vessels, often associated with various pathological conditions. When neovascularization is observed using Doppler ultrasound, it indicates increased vascular components in the area of interest. This can be indicative of angiogenesis, which is the growth of new blood vessels from existing ones. Increased vascularity can be associated with several conditions, including tumors, inflammation, and wound healing processes. In cases where neovascularization and increased vascular components are present, it is possible to observe skin temperature changes using thermography. Thermography is a method that uses infrared imaging to measure and visualize variations in skin temperature. Increased vascularity can lead to increased blood flow and metabolic activity in the area, which may result in local skin temperature elevation.[11–13] The combination of Doppler ultrasound findings indicating neovascularization and increased vascular components, along with thermography showing skin temperature elevation, suggests an active physiological response in the tissue. However, these findings do not consistently show a correlation with the formation of scars in filler complications cases.

Many studies have already shown that the most important treatment for filler complications is the injection of hyaluronidase as soon as the physician recognizes the adverse effects followed by providing immediate proper treatment.[14,15] In most of our cases, an immediate hyaluronidase injection was administered either right after the procedure or on the following day. However, in the case where the hyaluronidase injection was administered 4 days after the procedure, despite the absence of inflammatory signs in laboratory tests, clinical findings, Doppler ultrasound, and thermography, scar formation occurred. The treatment onset time is also important. Even when hyaluronidase injection was administered promptly, if the treatment was not performed within 2 days, the time to re-epithelialization was prolonged, and scar formation progressed.

In our cases, we observed that when inflammatory lesions including pustules and crusts did not progress, fibrous tissues did not replace the affected area and then, the skin lesions improved without leaving permanent scars. However, when crust lesions occurred following the formation of pustules on erythematous to violaceous patches, fibrous tissues developed on the skin lesions. In such cases, even with appropriate debridement and dressing, the tissue healing process leads to the replacement of fibrotic scar tissue.

Therefore, when assessing the clinical outcomes and prognosis of HA filler complications, observing the progression of the inflammatory process is crucial. If hyaluronidase injection or treatment initiation is delayed, it can lead to a transition to an inflammatory process.

**TABLE 1** Summary of the clinical profiles of the case patients.

| Case | Sex/age | Past medical history | Injection site | Hyaluronidase injection[a] | Dose of hyaluronidase | Treatment onset[a] | Doppler ultrasound | Thermography | WBC | ESR/CRP | Time to re-epithelialization | Clinical outcomes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | F/28 | None | NLF | Immediately | 1500U | First day | Increased vascular components | Higher skin temperature | Increased (9250) | Normal | 7 days | No scarring |
| 2 | F/52 | None | NLF | Fourth day | 1500U | Fifth day | Hypoechoic pseudocyst | Lower skin temperature | Increased (9980) | Normal | 21 days | Scar |
| 3 | F/33 | None | NLF | Immediately and first day | Unknown | Eighth day | Increased vascular components | Higher skin temperature | Highly increased (14370) | Increased (50 /22.8) | 21 days | Scar |
| 4 | F/28 | None | Nose | Immediately | 1500U | Third day | Non-specific findings | Lower skin temperature | Increased (12180) | Normal | 7 days | Scar |
| 5 | F/31 | None | Nose | First day | Unknown | Second day | Hypoechoic pseudocyst | Not checked | Increased (9840) | Normal | 14 days | No scarring |
| 6 | F/35 | None | NLF | Immediately | 1500U | Second day | Increased vascular components | Higher skin temperature | Increased (10760) | Increased (23/7.4) | 5 days | No scarring |

Abbreviation: NLF, nasolabial fold.

[a]The day of hyaluronidase injection and treatment onset after hyaluronic acid filler injection.

Assessing this progression relies not only on changes in skin lesions but also on laboratory findings, Doppler ultrasound, and thermography, which can provide valuable insights. The progression toward inflammation and fibrosis prolongs the re-epithelialization time, resulting in the formation of permanent scars in HA filler complications.

When considering the prognosis of filler complications, there are numerous factors to take into account, including the type and quantity of filler used, injection site, injection techniques, and patient-related factors. This study had limitations in that it evaluated the clinical outcomes of HA fillers complications based on post-procedural management and tissue reactions. Another limitation of this study is the small number of patients and the lack of detailed information about the injection procedure, such as injection technique, specific HA product used, and depth of injection, as these patients were transferred to our center after receiving filler procedures at other hospitals. However, this study contributes to a better understanding of the evaluation process for patients who present with complications after HA filler procedures. Further research with a larger sample size, longer follow-up period, and in-depth analysis is needed to assess the clinical outcomes and prognosis of filler complications.

## AUTHOR CONTRIBUTIONS

Beom Joon Kim contributed to the study conception and design. Data collection and analysis were performed by authors Sun Hye Shin and Joon Seok. Material preparation were performed by authors Sun Hye Shin. The first draft of the manuscript was written by author Sun Young Choi and reviewed & edited by authors Kwang Ho Yoo and Beom Joon Kim. All authors read and approved the final manuscript.

## CONFLICT OF INTEREST STATEMENT

None.

## DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article.

## ETHICS STATEMENT

The patients in this manuscript have given written informed consent to publication of their case details.

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