Case Report

Retinal Branch Artery Embolization Following Hyaluronic Acid Injection: A Case Report

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Abstract

Injection of hyaluronic acid (HA) filler is a common aesthetic procedure. Impairment of vision, although rare, is a devastating complication of this procedure, which may not be reversible. We report on a patient who experienced visual acuity impairment and ischemic oculomotor nerve palsy after injection of HA into the nasal dorsum. In this case, clinical signs improved within 14 days of treatment. We also provide a review of the mechanism, clinical features, risk factors, and prevention and treatment strategies relating to embolization of ocular circulation after injection of HA. Vision loss is a rare but devastating complication of injection of hyaluronic acid (HA) in the face. Visual acuity seldom recovers completely. We report on a 22-year-old Asian woman who experienced obstruction of a branch of the retinal artery after injection of HA to augment her nose. The patient’s visual acuity declined shortly after the procedure, and ophthalmoplegia occurred. Combination treatment was administered to restore the perfusion and oxygen supply to the retina and optic nerve. Within 14 days of rigorous treatment, the patient experienced improvement in visual acuity, extraocular movement, and visual field defects.

Level of Evidence: 5

Vision loss is a rare but devastating complication of injection of hyaluronic acid (HA) in the face. Visual acuity seldom recovers completely. We report on a 22-year-old Asian woman who experienced obstruction of a branch of the retinal artery after injection of HA to augment her nose. The patient’s visual acuity declined shortly after the procedure, and ophthalmoplegia occurred. Combination treatment was administered to restore the perfusion and oxygen supply to the retina and optic nerve. Within 14 days of rigorous treatment, the patient experienced improvement in visual acuity, extraocular movement, and visual field defects.

CASE PRESENTATION

On August 24, 2014, a healthy 22-year-old woman received injection of HA into the nasal dorsum at a private practice. This was the first time that she received HA injection. The type of the private practitioner who performed the procedure is not known. Approximately 10 minutes after injection, the patient experienced diplopia and orbital pain in her right eye. She was immediately transferred to the emergency department of our hospital (Peking University Shenzhen Hospital, Shenzhen, Guangdong, China). At this time, the glabella and nasal dorsum, along the distribution of dorsal nasal artery and angular artery, appeared erythematous, with violet reticular discoloration (Figures 1A, B). Her best-corrected visual acuity, according to the Snellen scale, was

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20/20 oculus utro (OU) upon arrival at our hospital. External strabismus was detected (Figure 1A) along with limitation of medial extraocular movement (Figure 1B). Cefuroxime and dexamethasone were administered immediately, but no improvement was observed. By the next morning, visual acuity decreased to 20/200 in the right eye (oculus dexter; OD) and 20/20 in the left eye (oculus sinister; OS).

Ptosis and ophthalmoplegia also were observed in the patient’s right eye. Pupil dilation, exotropia, visual field defect, and limitation of medial and downward extraocular movements were detected as well (Figure 2). Examination of ocular movements demonstrated partial palsy of the right trochlear nerve and the oculomotor nerve. A color fundus photograph of the right eye showed congestion of the optic disc, retinal edema superiorly, and whitening of the macula (consistent with cotton-wool patches and hard exudate), shortening of the braches of the retinal artery, and dilatation of veins (Figure 3). Fundus fluorescein angiography (FFA) of the right eye showed delayed filling of the superior temporal retinal artery (38 seconds) and defective choroidal filling in the later frames (Figure 4A). Results of systemic investigations, including magnetic resonance imaging of the brain, a chest radiograph, and blood tests for coagulopathy, were normal.

The patient was treated with topical timolol maleate, tobramycin-dexamethasone ophthalmic eye drops, and ocular massage. Additional treatments were performed to restore the perfusion and oxygen supply to the retina and optic nerve. These included intravenous injection of prostaglandin E1 (2 mL/d), periocular injection of anisodamine to dilate arteries, intravenous injection of dextran 40 (500 mL/d) to expand blood volume, intravenous injection of ozagrel (120 mg/d) to prevent thrombosis, and oxygen inhalation. Intramuscular
injection of methylcobalamin (0.5 mg/d) was performed for neuro-nutrition. A systemic steroid (dexamethasone 5 mg/d) was administered for 3 days. A topical antibacterial agent was applied to the affected skin for 10 days.

By 14 days of treatment, all skin lesions were healing, evident by crusting (Figures 1C, D). Visual acuity improved to 20/16 OD and 20/20 OS, and ocular position normalized. FFA demonstrated less-delayed filling of the superior temporal retinal artery (17 seconds).

**Figure 2.** (A) Visual field examination performed the day after hospital admission showed mean deviation of −29.80 dB. (B) After 10 days of treatment, the dark field was reduced, and the mean deviation improved to −20.79 dB.

**Figure 3.** (A) Four days after admission to the hospital, a color fundus photograph of the right eye showed congestion of optic disc, superior retinal edema, whitening of the macula (consistent with cotton-wool patches and hard exudate), decreasing branches of the retinal artery, and dilatation of veins. (B) Thirteen days after treatment initiation, the edema had faded, few patches of cotton-wool and hard exudate remained, and vascular distribution was nearly normal.
and better hemoperfusion (Figure 4B). The most recent follow-up examination of the patient (on October 10, 2015) showed that her skin lesions had healed normally and completely, and visual acuity had remained stable.

**DISCUSSION**

Since approval of the first injectable HA product in 2003, HA has become the most popular cosmetic soft-tissue filler. Although HA fillers generally are considered safe, complications may occur. Embolization of ocular circulation following injection of facial filler may cause substantial impairment of vision, as demonstrated by our case. Blindness is a rare but devastating complication, particularly because it is seldom reversible. Therefore, physicians must be keenly aware of the risk and severity of this adverse event.

**Mechanism of Vascular Compromise**

Distal branches of ophthalmic artery, including supraorbital artery, supratrochlear artery, and dorsal nasal artery, extend into the forehead and nose. These arteries are the most likely to be involved in vascular complications during injection of the glabella, nose, and forehead. If the tip of needle penetrates the wall of a distal branch of ophthalmic artery, the force of injection can expand arterioles and cause retrograde flow. If the pressure applied by the injector exceeds that of the systolic artery, the injected material may migrate to the proximal site of the arterial system and subsequently move distally, obstructing the ophthalmic or retinal artery and its branches when the plunger is released.

In our case, the site of injection and the area of necrosis indicate that the filler could have passed into the dorsal nasal artery originally. Retrogradation and migration of the HA embolus to the supratrochlear artery, lateral nasal artery, and branches of the retinal artery were responsible for the skin necrosis and the adverse ocular symptoms. The inflammation and edema, which exacerbated as time passed, might have resulted in the decrease of visual acuity after she presented to our hospital.

The patient was not sure if the injector was qualified to perform the procedure. Therefore, her injections may have been administered by a nonexpert who does not understand facial anatomy, thereby increasing the risk of vascular complications.

**Clinical Features**

When iatrogenic occlusion of the ophthalmic artery occurs, severe ocular pain and completely vision loss are the most common symptoms. In cases of iatrogenic occlusion of the central retinal artery or a branch of the retinal artery, decreased vision is common but ocular pain may be less severe. Park et al speculated that severe ocular pain and sudden blindness indicate ophthalmic artery occlusion and predict poor visual outcome. Other symptoms may include nausea, diaphoresis, ophthalmoplegia, corneal edema, pupillary abnormality, and neurologic effects. An initial toothache or headache may be indicative of this adverse event. If any of the above-mentioned symptoms arise, the clinician must terminate the injection immediately.

The clinical features associated with retinal artery occlusion differ according to the type of filler being injected.

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**Figure 4.** Fundus fluorescein angiography (FFA) images. (A) The day following admission, the right eye showed delayed filling of the superior temporal retinal artery and defective choroidal filling in the later FFA images. (B) After 14 days of treatment, filling of the superior temporal retinal artery was less delayed, and hemoperfusion was improved.
Patients who received HA were more likely to have localized ocular occlusion, with milder symptoms and better visual prognosis, than those who received autologous fat. Such differences may relate to the differences in particle size among the various types of filler.

**Prevention Strategies**

The treatment of visual deficits caused by filler injection usually is not successful. Therefore, strategies aimed at preventing vision damage are essential. Because most cases of this complication have been examined retrospectively, important details may be lacking, such as injection technique, injection device, or volume of filler – likely due to the fact that the ocular problems were managed (and reported) by clinicians other than the injector. Although no guidelines or procedures can prevent this complication entirely, reasonable strategies may decrease the risk of vascular occlusion (Table 1).

**Treatment Strategies**

Even when filler is injected by medical experts, embolization of the product into the ophthalmic artery is possible. It is important that injectors have a management strategy in place for dealing with this potential complication.

In the previously reported cases, treatments have included observation, ocular massage, intravenous acetazolamide and mannitol, systemic corticosteroids, oxygen inhalation, and others. However, the outcomes for these cases were not consistent, which makes it difficult to establish evidence-based treatment recommendations. The initial goal of treatment is rapid restoration of perfusion to the retina and optic nerve. After 90 minutes, the retinal necrosis and vision loss caused by ocular circulation embolization usually are irreversible.

Essential to rescuing visual function is early recognition of the symptoms of artery embolization plus rigorous treatment to restore perfusion of retina without delay. Recommended treatment measures are listed in Table 2. As noted by Park et al., patients who received HA were more likely to have localized ocular occlusion, with milder symptoms and better visual prognosis, than those who received autologous fat.

In our case, clinical signs partially recovered after treatment. We ascribed this not only to the fact that the original occlusion was circumscribed, but also to the expedient and comprehensive treatment that restored perfusion. In previous cases, treatment was incomplete, and nearly all patients underwent, at most, 3-step therapy. In our case, combination therapy was performed to restore perfusion of the retina, including periocular injection of anisodamine and intravenous injection of prostaglandin E1 and dextran 40. Periocular injection of anisodamine, which can dilate the ocular arteries directly, might have been the most crucial component of this therapy. Moreover, we provided other treatments, including topical eye drops to reduce intraocular pressure, systemic corticosteroids, systemic antibioic, oxygen inhalation, anticoagulation, and a neuro-nutrition drug.

**Hyaluronidase**

Hyaluronidase is an endogenous enzyme that can hydrolyze HA. This enzyme has proven effective in the management of hyaluronic acid-induced ocular occlusion. Table 1. Key Strategies to Prevent Vision Loss Associated With Hyaluronic Acid Injection

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<th>No.</th>
<th>Strategy</th>
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<tbody>
<tr>
<td>1</td>
<td>Be familiar with facial vascular anatomy and the common variations.</td>
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<td>2</td>
<td>Exercise extreme caution with any patient who has a history of facial plastic surgery.</td>
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<td>3</td>
<td>Avoid injection if previous trauma, chronic inflammation, or scarring is present at the intended injection site.</td>
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<td>4</td>
<td>Perform injections with recommended devices, such as small syringes, blunt flexible microcannulas, or nontraumatic flexible blunt tip needles.</td>
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<td>5</td>
<td>Apply a topical vasoconstrictor before injection.</td>
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<td>6</td>
<td>Aspirate before injection.</td>
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<td>7</td>
<td>Perform the injection slowly, with minimal pressure.</td>
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<td>8</td>
<td>Inject no more than 0.1 mL of hyaluronic acid per increment.</td>
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<tr>
<td>9</td>
<td>Inject the product at different points, in a retrograde manner.</td>
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<td>10</td>
<td>Cease injection immediately if resistance increases or clinical features arise.</td>
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**Table 2. Recommended Treatment Measures for Symptoms of Vision Loss Induced by Hyaluronic Acid Injection**

<table>
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<tr>
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<th>Treatment Measure</th>
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<tr>
<td>1</td>
<td>Most importantly, injection should be terminated as soon as evidence of ocular pain, vision loss, or vascular compromise of the skin becomes apparent. Also recommended are warm compresses, massage, and injection of hyaluronidase to the affected area(s). Immediately afterward, an ophthalmologist should be consulted and/or the patient transported to an ophthalmologic emergency department.</td>
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<tr>
<td>2</td>
<td>Ocular massage may help to decrease intraocular pressure and increase arterial blood flow.</td>
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<tr>
<td>3</td>
<td>Intravenous acetazolamide, intravenous mannitol, topical antiglaucoma drops, and anterior chamber paracentesis may help to reduce intraocular pressure and encourage blood flow in the retina.</td>
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<tr>
<td>4</td>
<td>Inhalation of carbogen (95% oxygen with 5% carbon dioxide) may improve dilation of the retinal arteries and delivery of oxygen.</td>
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<td>5</td>
<td>Sublingual isosorbide dinitrate or systemic pentoxifylline may further dilate the retinal arteries.</td>
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<tr>
<td>6</td>
<td>Systemic and topical corticosteroids may reduce retinal edema and the inflammatory reaction.</td>
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<tr>
<td>7</td>
<td>Others: fluid expansion, anticoagulation (with oral acetylsalicylic acid), low-molecular-weight heparin, intravenous prostaglandin E1, neuro-nutrition drug, intravenous antibiotics.</td>
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</table>
of complications resulting from HA injection. Clinicians are advised to have hyaluronidase available in case adverse events occur after HA injection, particularly to address tissue necrosis resulting from vascular occlusion. When indicated, hyaluronidase should be injected into the site of injection and surrounding areas. It is unfortunate that this treatment was not administered in the present case; however, all skin lesions did heal. Carruthers et al. suspected that, in the case of embolization of ocular circulation following injection of HA-based fillers, retrobulbar hyaluronidase injection might have the potential to rescue vision loss by hydrolyzing intravascular HA. However, to our knowledge, no clinical or animal experimental data exist concerning injection of hyaluronidase to manage vision loss induced by HA injection. Thus, the effectiveness or safety of hyaluronidase in such situations is not known. Hyaluronidases have been employed for retrobulbar anesthesia in ophthalmic surgery, and therefore it may be a potential strategy to treat the embolization of ocular circulation caused by HA injection. More scientific research is warranted.

CONCLUSIONS

Loss of vision is a rare but devastating complication of injection of HA filler, which often is not reversible. In our case, the patient experienced vision loss and ophthalmoplegia after injection of HA into the nasal dorsum to enhance the appearance of the nose. Partial improvement of clinical signs was attained after timely comprehensive treatment that restored perfusion of the retina and oculomotor nerve. Physicians should be cognizant of this adverse event and exercise preventive measures. If evidence of this complication emerges, such as ocular pain, injection must be stopped immediately and the patient transported to an ophthalmologic emergency department.

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REFERENCES