

### **A Rethink on Hyaluronidase Injection, Intraarterial Injection, and Blindness: Is There Another Option for Treatment of Retinal Artery Embolism Caused by Intraarterial Injection of Hyaluronic Acid?**

We read with interest the article by Belezny and coworkers<sup>1</sup> in *Dermatologic Surgery*. The supposed mechanism for blindness seems to be intraarterial injection reaching the ophthalmic artery circulation and embolization into the end retinal artery. Unfortunately, there are variations in the arterial patterns between individuals with some having the ophthalmic and facial arteries quite separate and some people where there are connections between these systems. This translates into somewhat bizarre cases where injections in the lower face, even the labial arteries, have ended up with vision loss. Anywhere with access to the ophthalmic circulation is a potential source of embolization, so the temporal circulation is also a potential for blindness as is the nose through the dorsal nasal artery or the cheek through the zygomaticofacial artery, both branches of the ophthalmic.

The presumed mechanism for this catastrophic event has been suggested to be retrograde flow of the filler in the artery filling from the peripheral branch of the blood vessel pushing against the arterial pressure until the flow reaches past the section of the ophthalmic system where the retinal artery begins. Letting go of the pressure on the injection reestablishes the arterial flow and the filler follows this new antegrade direction to end up in the retinal artery.

Usually with intraarterial injection, the end-arterial circulation is available for field treatment with hyaluronidase and the reticular pattern a sign of where the embolization has occurred. Usually, the advice is to flood the embolized area with hyaluronidase to unplug end vessels. The retinal artery is

an end vessel not accessible to this direct form of treatment.

We wish to point out another possible remediation of potential occlusive eye injury that we noted in one of our patients. A female patient was being injected deeply in her temples and brow with hyaluronic acid when she noted soon after the right lateral brow injection a flashing sensation in her right eye and partial loss of vision. The injecting physician injected hyaluronidase (hyalase, 375IU/mL) widely in the brow and forehead area where there seemed to be swelling contemporaneously with the visual changes. Widespread hyaluronidase in this area did not make any change to the visual symptoms. However, the practitioner then injected approximately 0.8 mL (300 units) of hyaluronidase twice in short succession into the area of the supratrochlear and supraorbital notches with the second injection bringing instant relief of visual symptoms and return of eyesight. Subsequent ophthalmic review and magnetic resonance imaging illustrated no retinal artery or product intracerebral event.

What might this tell us about the treatment of visual loss with hyaluronic acid and in fact teach us about hyaluronidase in any intraarterial injection?

It has been shown in a cadaver that injection in a vessel will dissolve intraarterial hyaluronic acid, however, injection only around the vessel will readily cross its wall and also dissolve the hyaluronic acid.

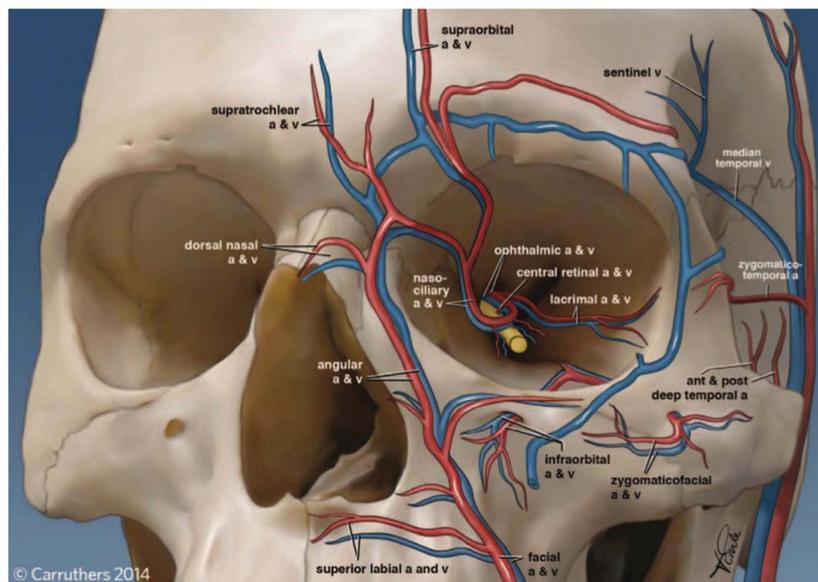
It is suggested that physicians be trained in the anatomy of the essential vessels of the face. Where possible

we should continue to inject peripheral end-vessel embolization with hyaluronidase into this broad field but also to inject hyaluronidase in and around the main feeding vessel. The concept would involve sufficient perivascular hyaluronidase to escape across the vessel wall and be carried into the embolized region by the forward arterial flow.

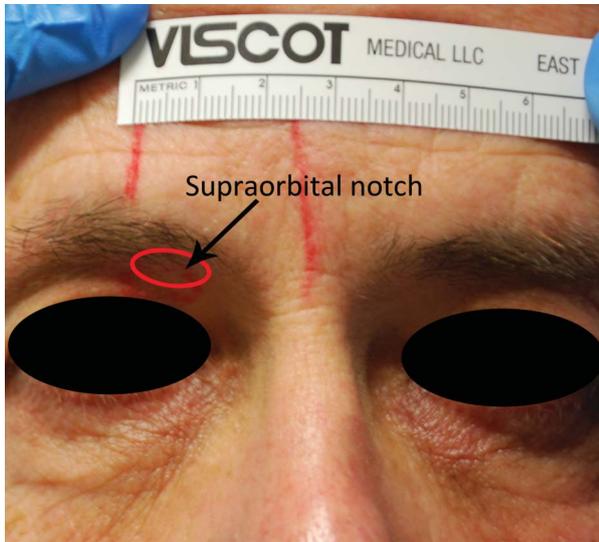
However, when end-vessel drainage is not accessible, such as with retinal artery embolization, then injecting into named vessels where they are relatively consistently and easily located would seem logical. The supraorbital and supratrochlear vessels are accessible and the notches where they exit the supero-medial aspect of the orbit (Figure 1) and both communicate with the ophthalmic circulation.

It may have been that the practitioner injected hyaluronidase directly into the supraorbital artery, although it may be good practice as spelt out above to inject sufficient hyaluronidase around a major feeding vessel in the expectation that the hyaluronidase will cross the vessel wall and be carried downstream by the arterial pressure where it may be free to dissolve the hyaluronic acid. However, in the retinal artery situation, this may not be feasible as it is not easy to reach the ophthalmic artery at its source and the retinal artery emanates earlier from the ophthalmic than the supraorbital and supratrochlear vessels (Figure 1). So

in this case, there needs to be sufficient retrograde pressure of hyaluronidase to back fill against the arterial flow of the supraorbital or supratrochlear vessels to glide into the ophthalmic artery, past the retinal artery and on release, fill the retinal artery with hyaluronidase under the reestablished normal forward arterial blood pressure. It may be that direct intravascular injection here is necessary with a purge of hyaluronidase. It is worth consideration by a treating practitioner to attempt this as was performed in this index case. The supraorbital origin is closer to the retinal artery origin from the ophthalmic artery (than the supratrochlear artery) and the notch is palpable as an identifiable landmark (Figure 2). The supratrochlear artery lies  $16.4 \pm 1.7$  mm, whereas the supraorbital artery lies  $26.5 \pm 2.6$  mm from the midline. Cadaver studies have shown that the supraorbital and supratrochlear arteries are capable of being cannulated and supported this approach to retinal artery occlusion.<sup>2</sup> Another study has suggested that a trans-orbital approach and cannulation of the retroseptal ophthalmic artery may be more practical<sup>3</sup> but this is not something that could be attempted at the bedside by the treating practitioner. It is best located by running a finger along the underside of the superior orbital rim from the supero-medial aspect of the orbit and pushing superiorly as the finger is slowly moved laterally (Figure 2) until a depression is located. Injection should be aimed into the notch from above and



**Figure 1.** Diagram of supratrochlear and supraorbital vessels exiting the supero-medial aspect of the orbit.



**Figure 2.** Diagram of supraorbital notch.

directed toward the origin of the artery (Figure 1), toward the eye. If this is not relieved, it may be that an interventional radiologist is called for to inject the supraorbital or supratrochlear vessel under direct guidance in addition to an ophthalmologist. A surgical approach could also be considered. Whatever procedure is contemplated, it must be timely because the eye has very limited ability to withstand ischemia.

It is likely that injecting hyaluronidase in the region of the supraorbital artery could be taught to treating physicians and would be a relatively harmless approach. With so many new injectors<sup>4</sup> who may not have a complete knowledge of the underlying facial anatomy, these simple landmarks may help their management of these complications. Similarly, but somewhat easier, this should be considered with any intraarterial injection such as the sidewall of the nose

or lips where the named vessels should be located relatively easily and accessed proximally with high-dose hyaluronidase in or even around these vessels is likely to be beneficial.

Unfortunately nondissolvable agents such as autologous fat, calcium hydroxyl apatite, polylactic acid, and the acrylates are not amenable to this treatment and should be used with extreme caution, if at all, in the high-risk areas mentioned in Belezny et al.<sup>1</sup>

## References

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## Commentary on a Rethink on Hyaluronidase Injection, Intra-arterial Injection and Blindness

I commend my colleagues, Dr. Goodman and Dr. Clague,<sup>1</sup> for an illustrative letter in response to the article by Belezny and coworkers<sup>2</sup> and their own case report adding an excellent explanation and description of the complicated facial vascular anatomy as it relates to the potential for blindness because of the injection of facial filling agents and

suggested remedies. They beautifully discuss the reality of the intercommunications of the arterial blood supply as it relates to what are now more commonly injected regions such as the temples, periorbital, nose, and the vast mid-face. Of all of their many good points, one thing becomes clear—there are definite anastomoses between many of the