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High-dose intraocular delivery of epinephrine by an auto-injector causing retinal trauma without arterial occlusion

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A 15 month old boy was inadvertently struck in his closed right eye with an EpiPen® Jr (Mylan, USA) by his 4-year-old sister and suffered presumed intraocular injection of 0.15 mg epinephrine. He had no significant past medical or ocular history. On examination, he was able to fixate and follow. Initially, the right pupil was extremely mydriatic and nonreactive, but no afferent pupillary defect was present. There was an area of ecchymosis near the upper eyelid crease where the needle had entered. A small puncture wound in the cornea was present at the 7:00 position near the limbus and was negative on Seidel testing. An iris defect was present just underneath the corneal wound (Figure 1, light and dark arrowheads). The anterior chamber was formed, without hyphema. Intraocular pressure was 6 mm Hg. The lens was clear. Anterior and posterior examinations of the left eye were normal.

Examination under anesthesia of the right eye revealed multiple intraretinal and pre-retinal dot blot hemorrhages around the optic nerve and macula (Figure 1B, asterisks). The optic nerve was well-perfused and displayed spontaneous venous pulsations. There was no retinal pallor, cherry-red spot, box-carring of the retinal vessels or other stigmata of arterial occlusion. A mid-peripheral ragged radial retinal tear was present at the 10:30 position (Figure 1B, dark arrowheads) and was surrounded by a small cuff of subretinal fluid (Figure 1B, light arrowheads). Indirect laser retinopexy and external cryopexy were applied to decrease the risk of progressive retinal detachment and for hemostasis at the torn retinal edges. Because of the penetration of a non-sterile foreign body, intraocular vancomycin (0.25 mg) and ceftazidime (0.5625 mg) were injected. The retina remained attached at the one month postoperative examination.

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Two months following retinopexy, the patient was fixating but not following with the right eye. Visual acuity by Cardiff testing was 20/160 and 20/50 in the right and left eye, respectively. In the right eye, a thick central epiretinal membrane had formed causing contracture of the entire macula (Figure 1C, asterisks) and an associated combined tractional-rhegmatogenous retinal detachment with avulsion of the original retinal break from the surrounding retinopexy (Figure 1C, arrowheads). He underwent vitrectomy, membranectomy and silicone oil tamponade. Five months after the original injury, his retina is fully attached with intact retinopexy around the superotemporal break (Figure 1D, arrowheads) and a residual inferior macular scar (Figure 1D, asterisk). He remains phakic with a clear lens and he is able to fixate with his right eye.

To our knowledge, this is the first report of a penetrating ocular injury due to an epinephrine auto-injector. There were immediate ocular sequelae from the injury, including traumatic retinal tear and retinal hemorrhages, and there were delayed consequences, such as aggressive epiretinal membrane formation and eventual tractional retinal detachment. Fortunately, the traumatic retinal tear spared the central retina and did not cause any apparent trauma to the underlying retinal pigment epithelium or cause a choroidal hemorrhage. Though he suffered a retinal detachment with proliferative vitreoretinopathy as a consequence of this injury, he has done well following surgery to date.

Remarkably, we saw no evidence of arterial occlusion on initial examination or during follow-up care. We expected impaired retinal perfusion due to epinephrine exposure, since it is a known arteriolar vasoconstrictor. Even intravitreal infusions of epinephrine at the dilute concentrations used intraoperatively (1:500,000 and 1:1,000,000) have been shown to decrease optic nerve head perfusion.¹ The concentration of epinephrine in an EpiPen® Jr (Mylan, USA) is several orders of magnitude higher (1:2000). We suspect that the epinephrine was delivered, as pupillary mydriasis was noted on initial examination. It is possible, however, that the full concentration of EpiPen® Jr (Mylan, USA) did not penetrate inside the globe, even with this finding. Despite the obvious penetration of the globe, no signs of arterial constriction were present on exam.

The multiple posterior pole hemorrhages could have been caused by one of several mechanisms. Most likely, he suffered a retinal vein occlusion secondary to transient intraocular hypertension from the large volume bolus. Changes in IOP have been studied in adults in the context of intravitreal injection of pharmaceuticals, in which IOP can elevate to 40 mmHg or more immediately after a 0.1 mL injection.² An even more dramatic change in IOP may have occurred in our patient as the injection volume may have been as large as 0.3 mL. The mean arterial pressure is also lower in children, so their retinal perfusion may be more susceptible to increases in IOP.

Hypotony and epinephrine exposure are less likely etiologies for the hemorrhages, but may have contributed. Transient hypotony may have occurred if there was significant reflux of fluid as the needle was removed or if there were chemical damage to the ciliary body. Retinal hemorrhage occurring in infants after cataract surgery has been attributed to hypotony. Because we did not observe a shallow anterior chamber or suprachoroidal effusions in this case, hypotony is a less likely cause of our patient's hemorrhages.

Epinephrine maculopathy after topical use for glaucoma causes retinal pallor and cystic changes with occasional retinal hemorrhages.³ However, there are no reports of intravitreal epinephrine at these high concentrations in non-glaucomatous eyes, so it is difficult to predict the impact it may have had on retinal vasculature.

In 2004, 2.5 million EpiPen® (Mylan, USA) prescriptions were filled and their use has continued to increase despite dramatic price increases in the last several years.⁴ These medication delivery devices are life-saving during severe anaphylactic reactions and should be kept readily accessible by those who may need them. There have been several case reports of self-injection into fingers, however no known cases of intraocular injection to our knowledge.⁵ Considering the ubiquity of epinephrine auto-injectors, and possible morbidity that may occur by inadvertent injection, parents should store these devices securely out of the reach of children.

References

1. Ubuka M, Sugiyama T, Onoda Y, et al. Changes in the blood flow of the optic nerve head induced by different concentrations of epinephrine in intravitreal infusion during vitreous surgery. *Invest Ophthalmol Vis Sci*. 2014; 55(3):1625–9. [PubMed: 24550362]
2. Benz MS, Albin TA, Holz ER, et al. Short-term course of intraocular pressure after intravitreal injection of triamcinolone acetonide. *Ophthalmology*. 2006; 113(7):1174–8. [PubMed: 16647122]
3. Kolker AE, Becker B. Epinephrine maculopathy. *Arch Ophthalmol*. 1968; 79(5):552–62. [PubMed: 5646032]
4. Camargo CA Jr, Clark S, Kaplan MS, et al. Regional differences in EpiPen prescriptions in the United States: the potential role of vitamin D. *J Allergy Clin Immunol*. 2007; 120(1):131–6. [PubMed: 17559916]
5. Mrvos R, Anderson BD, Krenzelok EP. Accidental injection of epinephrine from an autoinjector: invasive treatment not always required. *South Med J*. 2002; 95(3):318–20. [PubMed: 11902698]

Figure 1. EpiPen® Jr (Mylan, USA) -induced trauma to the anterior and posterior segment
 (A) The injury caused a peripheral traumatic iridotomy (light arrowhead) at 7:00 with a peaked pupil and a visible overlying self-sealing corneal laceration (dark arrowhead). (B) At the time of injury, a retinal tear was present in the upper temporal quadrant (dark arrowheads) with a surrounding limited subretinal fluid cuff (light arrowheads). Multiple intraretinal hemorrhages were present in the posterior pole (asterisks). (C) Two months later, the patient developed a combined tractional-rhegmatogenous retinal detachment, with avulsion of the original retinal break (arrowheads) and contracture of the entire macula (asterisks) around a central dark epiretinal membrane. (D) Five months post-injury, the retina is attached after vitrectomy, membrane delamination and silicone oil tamponade, with a well-supported original break (arrowheads) and a non-central macular scar (asterisk).