THE RETINA PARTNERS

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Case of the Month – January 2020

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A 3-month-old male was referred by his Pediatric Ophthalmologist for a unilateral cataract in the right eye (OD) and to "rule out retinoblastoma." His parents and Pediatrician had noted an abnormal red reflex in the OD. He was promptly referred. He had a normal prenatal and perinatal course and was born at 39 weeks and 2 days by uncomplicated vaginal delivery. He was feeding and developing normally and meeting his milestones. His parents felt that over the past 2 weeks, he seemed to be favoring his left eye (OS) over the OD.

On exam, he had poor fix and follow OD and good fix and follow OS with a 2.5-inch LED-lit ball at 1 foot. He became agitated with left eye cover, but not with right eye cover, demonstrating left eye preference. Intraocular pressures were normal. Anterior segment examination was significant for a cataract OD and was normal OS (Figure 1). The view posteriorly OD was limited due to cataract.

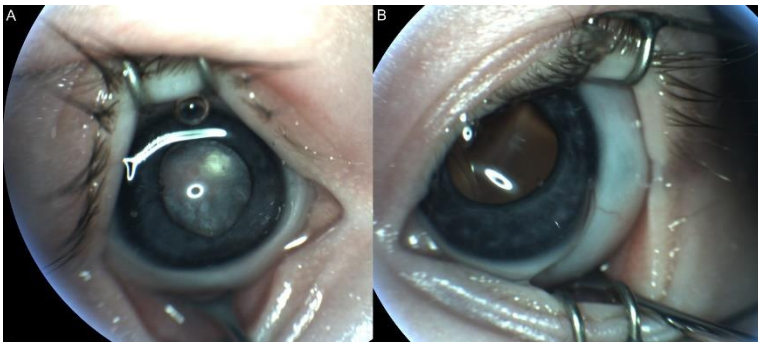

Figure 1: External photos revealed a dense cataract in the right eye (A) and a normal appearance of the left eye (B). The horizontal corneal diameter was approximately 0.5 mm smaller in the right eye, compared to the left eye.

Dilated fundus exam OS was unremarkable – the retina was vascularized to the nasal and temporal periphery, the vessels were normal in appearance, the foveal reflex appeared normal, and there was no obvious stalk emanating from the optic nerve (Figure 2).

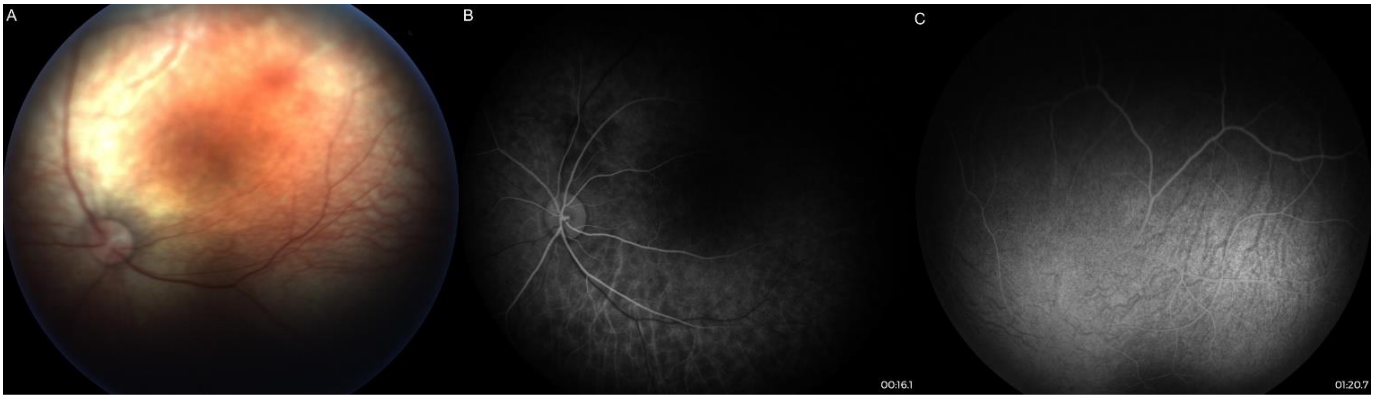

Figure 2: (A) Fundus photo of the left eye was normal. (B-C) Fluorescein angiography of the left eye was also unremarkable, with a normal AV transit time, normal retinal vessels without leakage, and no avascular periphery.

B-scan ultrasonography revealed a stalk from the disc to the lens in the OD, but not in the OS; there were no calcifications or masses (Figure 3). A diagnosis of persistent fetal vasculature (PFV) of the right eye was made and the findings were discussed with his parents. After discussion of the risks, benefits, and alternatives, the parents elected to proceed with surgery.

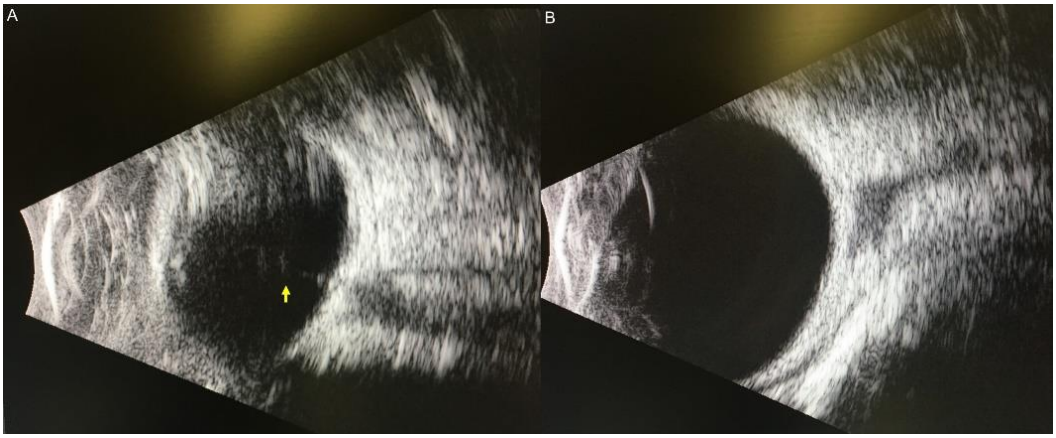

Figure 3: (A) B-scan of the right eye showed a stalk from the disc to the lens (yellow arrow). (B) B-scan of the left eye was normal.

Clinical Course:

Under anesthesia, both eyes were examined, and a fluorescein angiogram of the OS was performed. There was a normal AV transit time, a normal perifoveal microvascular network, and normal vessels without late leakage; importantly, there were no peripheral areas of capillary dropout (Figure 2B-C).

Attention was turned to the OD and 23-gauge vitrectomy, lensectomy, and stalk resection were performed. Vitrectomy was performed through the limbus, after placing a Lewicky anterior chamber maintainer (see Surgical Video: https://www.youtube.com/watch?v=wNIp_Sg2FaE). Careful attention was placed on the initial incision point into the lens capsule. In surgery for PFV, the best initial incision choice is made in the mid-peripheral to peripheral lens capsule. In some cases, there can be remnant stalk or retina pulled up to the ciliary processes. After the initial dissection, and then confirming that the retina was not pulled up anteriorly, the max grip forcep and the vitrector were used to perform lensectomy and membrane peeling, working away from the stalk initially. As the cataract was cleared, a view posteriorly was achieved. Under direct visualization with the BIOM, a small stalk from the disc to the lens was noted, and this was resected with the vitrector with minimal hemorrhaging. As the stalk was small, no cautery was needed. A partial fluid-air exchange was performed. The incisions were closed with 7-0 vicryl. Subconjunctival Ancef and Decadron were given.

The infant did well postoperatively. At post-op month 1, he was refracted by his Pediatric Ophthalmologist and Optometrist and given a contact lens for aphakia. The parents were able to manage the contact lens at home and at 6-month follow-up, he was found to have good fix and follow with a 2.5-inch toy at 1 foot with the OD and the OS. We had thorough discussions preoperatively and postoperatively with his parents about both the possibility of retinal dysplasia limiting his vision (even in the grossly normal-appearing eye), and the critical importance of long-term, refractive rehabilitation postoperatively to mitigate the effects of amblyopia.

Discussion:

Persistent fetal vasculature (PFV) is a congenital vitreoretinal dystrophy that occurs when the vascular structures present during ocular development fail to regress as they typically should. PFV was previously called persistent hyperplastic primary vitreous (PHPV). However, PHPV only addressed the primary vitreous, but failed to account for the tunica vasculosa lentis (TVL); the term “PHPV” has largely fallen out of favor.

There are two components to the fetal vasculature: the vascular meshwork surrounding the lens or the TVL, and the vascular connection of the TVL that extends back through the vitreous to the optic nerve (the hyaloidal artery or primary vitreous). If the hyaloidal artery fails to regress or incompletely involutes, it leaves a Mittendorf Dot in the lens capsule posteriorly. The hyaloidal artery should involute by apoptosis, starting at approximately the 28th week of gestational age, and the involution should be completed by birth, typically leaving Cloquet’s canal. The TVL subsequently regresses in a similar fashion. The findings in PFV depend on whether one or both of these components of the fetal vasculature are affected and to what severity. While PFV is not typically a progressive disease, tractional pathology can progress as the eye grows.

There are 3 presentations of the disease: classic PFV, eccentric PFV, and multifocal PFV. In classic PFV, 90% of cases are unilateral, the eye is typically microphthalmic (smaller axial length and corneal diameter), leukocoria may be present at birth, ciliary processes may be pulled in, and the stalk emanates from the optic nerve and inserts into and is intrinsic with the posterior lens capsule. Subclinical retinal dysplasia may be present and limit the visual potential. There are variations in which there can be multiple stalks from the retina to the lens, as well as a posterior form with a peripapillary starfish-shaped retinal area and stalk that does not reach the lens.

In eccentric PFV, patients may present at 6-8 months of age with strabismus. In these cases, there is a stalk from the disc to the lens, and the stalk is wrapped posteriorly with a tractional retinal detachment, causing foveal drag and detachment. The stalk typically inserts eccentrically into the lens in these cases. The stalk can significantly regress once surgically divided. Macroscopic or microscopic retinal dysplasia may limit vision.

The advent of widefield fluorescein angiography (WFA) has led to the discovery of a third form of the disease – multifocal PFV. In these cases, there are patches of peripheral avascular retina. Vessel remnants are

noted along the retinal surface and at the disc, which do not behave as new vessels, but rather represent isolated parts of the primary vitreous which failed to involute. The genetically driven apoptotic involution of PFV vessels is blocked by vascular endothelial growth factor (VEGF), as happens in retinopathy of prematurity (ROP). In multifocal PFV, it appears that there is enough VEGF to prevent complete involution, but not enough VEGF to drive neovascularization and exudation. The *Wnt* signaling system is typically intact in these patients. WFA is also helpful to ascertain that there is not also a concomitant *Wnt*-signaling disease such as Familial Exudative Vitreoretinopathy (FEVR), as there have been a handful of such cases reported.

Of critical importance in any referral of an infant with leukocoria is to rule out retinoblastoma, as missing the diagnosis can lead to mortality. On B-scan ultrasonography, retinoblastoma is characterized by hyperechoic calcifications and a mass. Even in the absence of a mass, calcifications on B-scan should be highly concerning in patients with leukocoria and warrants referral to an expert.

The prognosis in patients with PFV depends on the severity of the disease, the presence or absence of retinal dysplasia, and the commitment to postoperative refractive rehabilitation by the family. Cases with a severely thick stalk, with retina pulled up anteriorly or retinal detachment, or with elongated ciliary processes, portend a worse prognosis. Even when the anatomy appears normal, there can be a degree of subclinical retinal dysplasia that limits the visual potential. Techniques for early detection of retinal dysplasia are being optimized. The partnership between the family and the Pediatric Ophthalmologist and Optometrist, and the commitment of the family to using an aphakic contact lens (in cases with cataract requiring lensectomy) or spectacles, as well as patching, is critical for achieving the best possible vision, stereoacuity, and monofixation long-term.

The surgical techniques for the treatment of PFV have greatly evolved. Smaller gauge instrumentation has allowed for improved fluid dynamics. An anterior approach, through the limbus or cornea, is preferred in cases with cataract. The lens should be spared when possible, especially when the stalk does not insert into capsule along the central visual axis. In cases with a dense cataract, initial dissections into the lenticular capsule are best made with blunt dissection into the mid-peripheral to peripheral capsule in cases of PFV. It is important to transect the stalk as anteriorly as possible; it cannot be completely removed from the lens capsule because it is integrated into the capsule. For smaller stalks, cautery may not be necessary. For larger stalks, it can be helpful to perform core vitrectomy preferentially on the macular side of the stalk. Asymmetric vitrectomy can help prevent the resected stalk from falling onto the macula. Smaller stalks tend to involute more than larger ones.

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Take Home Points: Persistent Fetal Vasculature

- The fetal vasculature consists of the tunica vasculosa lentis and the hyaloidal artery. Failure of either to regress leads to Persistent Fetal Vasculature (PFV).
- There are 3 subtypes of PFV: classic, eccentric, and multifocal. Surgical advances have led to improved outcomes.
- Subclinical retinal dysplasia and amblyopia may limit the visual prognosis. Close partnership with the family and the Pediatric Ophthalmologist and Optometrist is critical for the best outcomes.

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