Intraocular Anesthetic Following Peribulbar Anesthesia

The incidence of globe perforation following peribulbar anesthesia is rare, occurring in 0.006% of the cases in a recent series. The incidence of intraocular anesthetic injection is also rare; only 4 cases have been reported in the English-language literature. We report a case of an intraocular injection of a combination of bupivacaine hydrochloride and mepivacaine hydrochloride following globe perforation during peribulbar anesthesia.

Report of a Case. A 53-year-old woman underwent phacoemulsification with placement of a posterior chamber intraocular lens for a cataract in the left eye. During the preoperative block, 2 peribulbar injections were given; the first infratemporally using 2 mL of anesthetic and the second supranasally using 1 mL of anesthetic. The anesthetic mixture contained 0.75% bupivacaine hydrochloride, 2% mepivacaine hydrochloride, and 150-U hyaluronidase. After the second injection, the patient noted to herself that vision in the eye immediately became no light perception. There was no pain. No complications were noted by the surgeon (M.B.W.).

Cataract surgery was performed through a clear corneal incision. The nucleus was removed with phacoemulsification and a foldable silicone lens was placed in the capsular bag. There were no intraoperative complications. A collagen shield soaked in a combination solution of dexamethasone and tobramycin (Tobradex, Alcon Laboratories Inc, Fort Worth, Tex) was placed on the eye with a light pressure dressing.

Twenty-four hours after surgery, visual acuity in the eye that was operated on was count fingers. An afferent pupillary defect was present. The sutureless corneal incision was tightly sealed, the cornea was clear, the anterior chamber was deep with 1+ cell, and the posterior chamber was well positioned in an intact capsular bag. The intraocular pressure was 12 mm Hg. The optic nerve appeared healthy with good perfusion and sharp disc margins. The retinal vasculature was normal and the macula was healthy. Retinal examination revealed a 2-disc-area subretinal hemorrhage adjacent to a yellow choroidal perforation site at the equator supranasal to the optic nerve (Figure). A posterior vitreous separation with trace vitreous hemorrhage was overlying the area. Fluorescein angiography showed normal retinal vascular filling. An orbital magnetic resonance imaging scan showed a normal optic nerve and retrobulbar space. Electroretinography was declined by the patient.

Thirty hours after surgery, visual acuity improved to 20/200, 20/80 by pinhole test. Seventy-two hours after surgery, visual acuity recovered to 20/60, 20/25 by pinhole test. One week after surgery, best-corrected visual acuity was 20/20 OS. No retinal complications have arisen from the perforation site.

Comment. Four reported cases of globe perforation with inadvertent intraocular anesthetic injection involved the use of lidocaine with or without epinephrine. Three patients regained 20/40 or better vision. Although initially no light perception was noted, visual acuity generally returned to near-normal by the morning after surgery. The fourth patient lost vision due to an associated large subretinal hemorrhage.

Our case is different, in that, a combined mixture of bupivacaine, mepivacaine, and hyaluronidase was inadvertently injected into the eye following peribulbar injection. Bupivacaine and mepivacaine chemically resemble lidocaine but have different pharmacologic properties. Mepivacaine is more rapid in onset than lidocaine, and bupivacaine is capable of producing more prolonged analgesia. This may explain why immediate visual loss to no light perception was noted by our patient and why some degree of visual loss persisted for almost 72 hours after the injection. Our patient also received intraocular hyaluronidase. Hyaluronidase has been shown to have no adverse effect on the retina in an animal study.

Although usually safe, peribulbar anesthesia has potentially sight-threatening complications (ie, retrobulbar hemorrhage, optic nerve damage, central retinal artery occlusion, and globe perforation). The incidence of globe perforation is low, but the incidence of recognized intraocular anesthetic injection is even lower. This may be due to 3 factors: (1) the diagnosis of globe perforation is made at the time of local anesthetic injection only 50% of the
time; (2) it is estimated that 0.3 to 0.5 mL of intraocular fluid are required to produce sufficient intraocular pressure elevation to be visibly noticeable (i.e., corneal edema); therefore, small volumes injected intraocularly could go unnoticed; and (3) a common anesthetic agent for ophthalmic anesthesia is lidocaine. Visual acuity has been reported to return to near normal within 16 hours of inadvertent intraocular lidocaine injection in a human subject. Very few first postoperative checks are made within 16 hours of surgery.

In our case, the diagnosis of globe perforation was not made at the time of injection. Only a small volume of fluid was injected intraocularly, and the intraocular pressure was not notably elevated. The diagnosis was made only because of the prolonged anesthetic effect of bupivacaine and mepivacaine on the intraocular structures.

Because “100% safe” anesthesia cannot exist, it is reassuring to the ophthalmic surgeon who may be confronted with an inadvertent injection of anesthetic agent that lidocaine, bupivacaine, and mepivacaine, without or without epinephrine or hyaluronidase, are well tolerated by the eye in small amounts. However, recognition of this complication is problematic. It has been recommended that time be taken to inspect the eye carefully after every retrobulbar and peribulbar injection.

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Study of the Norrie Disease Gene in 2 Patients With Bilateral Persistent Hyperplastic Primary Vitreous

We read with interest the article published in the ARCHIVES by Chynn and colleagues who described a full-term male neonate who had bilateral leukocoria, vascularized retrolental membranes, and hemorrhagic retinal detachments. Histopathological examination of 1 eye at the age of 5 weeks revealed elongated ciliary processes, large retrolental vessels, hemorrhagic retinal detachment, and retinal dysplasia—findings indicative of either Norrie disease (ND) or persistent hyperplastic primary vitreous (PHPV). The authors subsequently performed molecular genetic analysis and identified a 1-base-pair deletion in codon 35 of the ND gene, thereby establishing a diagnosis of ND.

As Chynn’s study illustrates, the clinical distinction between sporadic ND without systemic manifestations and bilateral PHPV can be difficult and has led to much confusion, with many authors stating that bilateral PHPV occurs in 10% of cases while others believe that bilateral PHPV is extremely rare or may not exist. In addition, it is common in our experience that genetic screening of children with ocular findings consistent with ND or PHPV is negative for mutations in the ND gene. Since mutations in the ND gene have been identified in patients with ND,2,3 we investigated whether mutations in the ND gene were present in 2 unrelated patients with ocular findings consistent with bilateral PHPV to facilitate the identification and classification of these 2 disorders.

Report of Cases. Case 1. A 4-year-old healthy Hispanic boy had decreased visual acuity since birth, and developed horizontal jerk nystagmus at approximately 10 weeks of age. Medical, family, and birth histories were unremarkable. On ocular examination, visual acuity was counting fingers in both eyes. Anterior segments were normal and confluent plaques, retinal detachment, and corneal diameters were 10.5 mm OU. Funduscopic examination of the right eye revealed a large fibroglial stalk emanating from the center of the optic disc. Peripapillary vessels were drawn into the stalk and the peripapillary retina was elevated and appeared dysplastic. Similar findings were observed in the left eye.

Case 2. A healthy, full-term, 2-week-old white boy was referred for bilateral retinal detachments. An alert visual evoked potentials measurement revealed tentative P100 wave forms at appropriate absolute latencies in both eyes. On clinical examination the corneal diameter measured 9.5 mm OD and 10.0 mm OS. Both eyes showed elongated ciliary processes, vascularized retrolental masses, and vitreous hemorrhage. A luxuriantly vascularized stalk extended from the optic nerve to the posterior lens. The underlying retina was completely detached and, apart from a portion of the nasal retina, was almost completely devoid of vascularization. Similar findings were observed in the left eye.

Genomic DNA from both patients was amplified using the polymerase chain reaction with primers designed to amplify exons of the ND gene.2 The polymerase chain reaction products were subcloned and sequenced using standard techniques. In both cases the entire coding region of the ND gene, including splice sites, was sequenced. The results revealed a wild-type sequence in both patients, supporting a diagnosis of bilateral PHPV rather than ND.

Comment. Norrie disease is an X-linked recessive syndrome characterized by hemorrhagic retinal detachment, PHPV, retinal dysplasia, and vitreous hemorrhage, with bilateral blindness typically observed at birth. Mild to severe mental retardation and progressive sensorineural hearing loss are common associations.

In contrast with ND, PHPV is a sporadic, nonhereditary malformation of the eye and is not associated with systemic abnormalities. The clinical spectrum of PHPV is broad. In severe cases, microphthalmia, retrolental fibrovascular plaques, retinal detachment, and...
retinal dysplasia may occur, leading to cataract, secondary glaucoma, and eventually, phthisis. Therefore, when bilateral ocular manifestations are encountered that are consistent with severe PHPV in the absence of a family history and systemic abnormalities, the distinction between bilateral PHPV and ND remains an area of confusion. In the current study, one of the patients had only posterior involvement while the other subject was more severely affected and had both anterior and posterior involvement, simulating ND. In both cases no nucleotide alterations were found in the ND gene.

No genetic or biochemical abnormalities have been identified in cases of PHPV to date. Although the gene(s) responsible for PHPV is unknown, the lack of inheritance and the unilaterality of the disease suggest that sporadic somatic mutations may be responsible for the disease. However, it is conceivable that unilateral PHPV, bilateral PHPV, and ND represent 3 separate clinical entities with unique underlying mechanisms. In addition, we cannot exclude the possibility that unilateral PHPV, or even bilateral PHPV, represent a developmental defect caused by environmental factors during embryogenesis, rather than by genetic factors.

Although we cannot definitively exclude the ND gene as a candidate gene for PHPV, it seems as if, in the 2 cases of bilateral PHPV described in this study, mutations in the ND gene are not responsible for ND. This further suggests that bilateral PHPV and ND are distinct clinical entities. The molecular genetic analysis of DNA from additional patients with ND and bilateral PHPV will be necessary to confirm this hypothesis.

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Idiopathic Polypoidal Choroidal Vasculopathy: A Peripheral Lesion

Idiopathic polypoidal choroidal vasculopathy (IPCV) is a peculiar vascular abnormality of the inner choroid, composed of 2 components, a network of branching vessels of variable dimension, terminating in aneurysmal-like enlargements with episodic serosanguineous detachments of the retinal pigment epithelium and neurosensory retina. The network of vessels usually emanates from the peripapillary area or less commonly as an isolated macular lesion. While sometimes clinically evident beneath atrophic pigment epithelium as reddish orange, spheroidal or polyplike structures, the vascular abnormality is most clearly discernible using indocyanine green angiography for enhanced choroidal imaging. We report, to our knowledge, the first case of a peripheral IPCV seen with subretinal hemorrhage.

Report of a Case. A 58-year-old white woman with no previous ocular or systemic history was noted to have a focal area of subretinal hemorrhage of several disc diameters in the inferior temporal fundus (Figure 1). The far peripheral retina and the macular region revealed no associated abnormalities. A fluorescein angiogram showed a patchy area of subretinal staining of undetermined origin, along with hypofluorescence or blockage of the choroidal circulation by blood. An indocyanine green videoangiogram revealed the presence of an inner choroidal vascular abnormality, ending in multiple small, hyperfluorescent polyps, characteristic of the IPCV abnormality (Figure 2). There was no vascular abnormality of the inner choroid in the fellow eye.

Comment. The vascular abnormality in IPCV is associated with mul-
Figure 2. Composite image of the late indocyanine green angiogram reveals multiple polypoidal lesions; the largest one is leaking beneath the hemorrhage. The hyperfluorescent area just superior nasal to the foveal avascular zone corresponds to an area of thin or hypopigmented retinal pigment epithelium.

In 1952, Wildervanck1 described a cerovico-oculo-acoustic syndrome consisting of Klippel-Feil deformity, abducens palsy with globe retraction, and congenital hearing loss. Subsequent reports have confirmed that the Wildervanck syndrome occurs sporadically, preferentially affects girls, and may be associated with paralysis of other lower cranial nerves.2 We describe a posterior fossa malformation complex with hypoplasia of the brainstem that was demonstrated by magnetic resonance imaging in a child with Wildervanck syndrome.

Report of a Case. A 5-month-old girl was referred to us for evaluation of intermittent esotropia. She was born at 37 weeks gestational age and weighed 2.2 kg at birth. A maternal great-grandfather had a history of Sprengel deformity (congenital elevation of the scapula), but a fraternal twin and 2 older sisters had no malformations. The findings of a facial examination included esotropia, diminished lower facial tone, low-set ears, and bilateral hearing aids (Figure, A). Skeletal abnormalities included thoracic kyphosis; a webbed, foreshortened neck with decreased mobility; and bilateral Sprengel deformity. A neurologic consultation disclosed left peripheral facial palsy, poor elevation of the palate, and hyperreflexia of the lower extremities.

The patient was able to follow vertical optokinetic stimuli using either eye. Her pupils reacted normally to light, with no afferent pupillary defect. She had 20 prism diopeters of intermittent esotropia in

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Brainstem Hypoplasia in the Wildervanck (Cerivico-oculo-acoustic) Syndrome

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primary gaze associated with an inability to abduct either eye, mildly limited adduction of both eyes, and full vertical gaze (Figure, B). Attempted lateral gaze in either direction produced a widening of the palpebral fissure of the abducting eye and a narrowing of the palpebral fissure of the adducting eye. The left eyelids closed incompletely during blinking. Emotional tearing was absent in both eyes, but the left eye teared during oral feedings (ie, crocodile tears). Retinoscopy after cycloplegia disclosed a refractive error of +3.50×0.50×10° in the right eye and +5.00 in the left eye. This spectacle correction eliminated her esotropia in primary position.

Spinal x-ray films showed severe thoracic kyphosis with absent posterior arches of the upper cervical bodies, a widened interpedicular distance in the cervical and proximal thoracic spine, and fusion of the spinous processes of the third and fourth cervical vertebrae to the occiput. Computed tomographic scanning of the cervical spine showed fusion of the lateral vertebral masses.

Magnetic resonance imaging of the head showed brainstem hypoplasia, primarily involving the pons and medulla, with ectasia of the basilar cisterns, foramen magnum, and upper cervical canal (Figure, C and D). Brainstem auditory evoked potentials were decreased bilaterally, contributing to a combined sensorineural and conductive hearing loss. The results of an echocardiogram disclosed dextrocardia. A fundoplication procedure with gastrostomy tube placement was performed when the patient was 4 months old be-
cause of swallowing incoordination, gastroesophageal reflux, and failure to thrive. The results of a chromosome analysis were normal.

**Comment.** Wildervanck syndrome comprises the clinical triad of Klippel-Feil deformity (fusion of ≥1 cervical vertebrae), Duane retraction syndrome, and hearing loss. The neck is short, thick, webbed, and immoveable. The head seems to sit directly on the trunk. Other spinal deformities (spina bifida occulta, Sprengel deformity, hemivertebrae, fusion of the ribs, absent ribs, kyphosis, scoliosis, and basilar impression) may coexist. Hearing loss in patients with the Wildervanck syndrome may be sensorineural, conductive, or mixed and may be accompanied by malformations of the external ear, external acoustic meatus, ossicles, and bony labyrinth.

Intelligence may be mildly to severely reduced.

The differential diagnosis of Duane retraction syndrome associated with other lower cranial nerve palsies includes Moebius syndrome and oculoauriculo vertebral dysplasia (ie, the Goldenhar spectrum). The finding of crocodile tears (paradoxical gustatory-lacrimal reflex) in our patient indicates misinnervation from a salivary branch of the paretic left facial nerve to the lacrimal gland. Its association with Duane retraction syndrome in this patient and in previous patients implicates an abnormality in the immediate vicinity of the abducens nucleus.

The single previous report of magnetic resonance imaging in a case of Wildervanck syndrome showed a similar posterior fossa malformation with hypoplasia of the brainstem and cerebellum, basilar invagination, and failure of vertebral segmentation. In our case, magnetic resonance imaging showed enlargement of the prepon tine cistern; ectasia of the foramen magnum; and diffuse hypoplasia of the brainstem, which accounted for the constellation of lower cranial nerve palsies (involving cranial nerves VI-VIII and possibly IX and X) observed clinically. This neuroimaging profile may prove useful in confirming future cases of Wildervanck syndrome and in distinguishing them from closely related malformation syndromes.

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