5. Labowsky M, Lim M, Abbobakar IF, Freedman SF. Red eye after strabismus surgery: community acquired MRSA periocular infection. J AAPOS 2016;20:448.e1-2.
6. Ing MR. Infection following strabismus surgery. Ophthalmic Surg 1991;22:41-3.
7. Kivlin JD, Wilson ME Jr. Periocular infection after strabismus surgery. The Periocular Infection Study Group. J Pediatr Ophthalmol Strabismus 1995;32:42-9.
8. House RJ, Rotruck JC, Enyedi LB, Wallace DK, Saleh E, Freedman SF. Postoperative infection following strabismus surgery: case series and increased incidence in a single referral center. J AAPOS 2019;23:26.e1-7.
9. Koederitz NM, Neely DE, Plager DA, et al. Postoperative povidone-iodine prophylaxis in strabismus surgery. J AAPOS 2008;12:396-400.

Childhood glaucoma in association with congenital disorder of glycosylation caused by mutations in fucosyltransferase 8

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A rare form of congenital disorder of glycosylation (CDG) was recently discovered in individuals with biallelic mutations in fucosyltransferase 8 (*FUT8*). The clinical characteristics of patients with *FUT8*-CDG include intrauterine growth retardation, feeding difficulties, hypotonia, microcephaly, seizures, short stature, developmental delay, and respiratory abnormalities. We report the first case of glaucoma in an infant with *FUT8*-CGD and hypothesize a pathogenesis for glaucoma.

Case Report

A 5-month-old girl was referred to our pediatric ophthalmology clinic at the University of Minnesota for evaluation of tearing, photosensitivity, and possible congenital glaucoma. Her past medical history included intrauterine growth retardation, seizures, hypotonia, facial dysmorphism, feeding difficulties, respiratory disease, and developmental delays. The patient had been recently diagnosed with *FUT8*-CGD after whole exome sequencing identified 2 variants in *FUT8* (c.1009C>G p.Arg337Gly within exon 8 and a c.1259+5G>T splice site variant within intron 9), and functional studies showed a complete lack of *FUT8* protein and loss of core fucosylation. There were no pathogenic variants in *CYP1B1*, *LTBP2*, or *TEK*, genes associated with infantile glaucoma.

On first examination, her vision was central, steady, and maintained in both eyes. Pupils and ocular motility were normal. The cornea of the right eye was clear. The left eye appeared buphthalmic, with a diffusely hazy cornea. Intraocular pressure (IOP) measured using the iCare tonometer (Icare Finland Oy, Vantaa, Finland) was 16 mm Hg in the right eye and 21 mm Hg in the left eye. Dilated fundus examination revealed a cup:disk ratio of 0.25 in the right eye and 0.45 in the left eye. Cycloplegic refraction was –1.00 sphere in the right eye and –1.50 sphere in the left eye.

Examination under anesthesia was recommended. The patient was dilated with a mixture of cyclopentolate 1.3%, tropicamide 0.17%, and phenylephrine 1.7%. IOP measured with Tono-Pen (Reichert Technologies, Depew, NY) was 18 mm Hg in the right eye and 36 mm Hg in the left eye immediately on induction of general anesthesia. Corneal diameters were 11.5 × 11.5 mm in the right eye and 12.5 × 12.5 mm in the left eye. Central corneal thickness was 538 μm in the right eye and 624 μm in the left eye. Axial length was 20.75 mm in the right eye and 22.57 mm in the left eye. Anterior segment examination of the right eye was unremarkable. Gonioscopy of the right eye revealed an immature angle with prominent radial iris angle vessels and a high iris insertion. The trabecular meshwork was not clearly defined. Indirect ophthalmoscopy revealed a normal macula and optic nerve, and a cup:disk ratio of 0.2. Anterior segment examination of the left eye revealed a notably buphthalmic eye with diffuse corneal edema, preventing a view of the angle on attempted gonioscopy. Indirect ophthalmoscopy revealed normal macula and vessels. There was an optic cup:disk ratio of 0.4.

A temporal Harms trabeculotomy was performed in the left eye. After surgery, the IOP improved to 21 mm Hg, and the corneal edema cleared, but the IOP increased to 29 mm Hg 1 year later. The patient was started on brinzolamide ophthalmic suspension 1% three times daily, and IOP was maintained below 24 mm Hg. The IOP of the right eye remained normal without treatment. Amblyopia of the left eye was detected 3 months after surgery. Cycloplegic refraction indicated significant anisometropia (right, −1.25 + 1.25 ×120; left, −4.50 +1.00 ×45); the patient was treated with glasses and part-time patching until her death due to respiratory complications at 3 years of age.

Discussion

The *FUT8* gene is widely expressed in mammalian tissues and catalyzes the core fucosylation of N-glycans in the biosynthesis of glycoproteins. Core fucosylation has been

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shown to have a significant effect on cell growth and differentiation.[1] *FUT8*-CDG is rare; to our knowledge, only 2 individuals other than our patient have been reported with pathogenic variants,[2] and our patient is the first case of *FUT8*-CGD associated with glaucoma. Of note, whole exome sequencing revealed no abnormalities in known genes for primary congenital glaucoma or other glaucomas. Therefore, we propose *FUT8*-CDG as a new etiology of glaucoma and classify it as a "glaucoma associated with a nonacquired systemic syndrome," according to the World Glaucoma Association's childhood glaucoma classification system.[3]

Overexpression of the *FUT8* gene has been found in the trabecular meshwork of eyes with primary open-angle glaucoma and is thought to play an important role in the regulation of the aqueous outflow.[4] Imbalances in both up-regulation and down-regulation of a single gene may cause a broad range of diseases.[5] We cannot rule out the possibility that our patient had glaucoma unrelated to the mutations in *FUT8*; however, given the absence of any other glaucomatous genetic abnormalities on whole exome sequencing and the significant improvement in IOP with trabeculotomy, we suspect that reduced expression of the gene was either directly causative of the glaucoma or acted as a cofactor to exacerbate her infantile-onset glaucoma. To our knowledge, this is the first evidence to suggest that reduced expression of the *FUT8* gene dysregulates aqueous outflow at the level of the trabecular meshwork and results in an infantile-onset variant of open angle glaucoma.

The mortality in individuals with *FUT8*-CGD is expected to be high. Studies have shown that 70% of *FUT8* knockout mice usually die within 3 days of birth, and survivors display growth retardation and severe respiratory problems.[6] Two of the 3 known individuals with *FUT8*-CGD have died before 8 years of age from respiratory diseases.

FUT8-CGD should be considered in the differential diagnosis of patients with infantile-onset glaucoma who present with intrauterine growth retardation, feeding difficulties, hypotonia, microcephaly, seizures, short stature, developmental delay, and respiratory abnormalities. Children diagnosed with FUT8-CGD should be evaluated for potential glaucoma. Future studies of *FUT8*'s role in the trabecular meshwork could further elucidate the exact pathogenesis of aqueous outflow obstruction and guide therapeutic developments.

Literature Search

PubMed and Google Scholar were searched on June 16, 2019, without date restriction, for English-language results using the following terms: *congenital disorder of glycosylation* AND *glaucoma*, *fucosyltransferase 8* AND *trabecular meshwork*, *fucosyltransferase 8* AND *glaucoma*.

References

1. Wang X, Gu J, Miyoshi E, Honke K, Taniguchi N. Phenotype changes of *Fut8* knockout mouse: core fucosylation is crucial for the function of growth factor receptor(s). Methods Enzymol 2006;417:11-22.
2. Ng BG, Xu G, Chandy N, Steyermark J, et al. Biallelic mutations in *FUT8* cause a congenital disorder of glycosylation with defective fucosylation. Am J Hum Genet 2018;102:188-95.
3. Thau A, Lloyd M, Freedman S, Beck A, Grajewski A, Levin AV. New classification system for pediatric glaucoma: implications for clinical care and a research registry. Curr Opin Ophthalmol 2018;29:385-94.
4. Diskin S, Kumar J, Cao Z, Schuman JS, Gilmartin T, Head SR, Panjwani N. Detection of differentially expressed glycogenes in trabecular meshwork of eyes with primary open-angle glaucoma. Invest Ophthalmol Vis Sci 2006;47:1491-9.
5. Lee TI, Young RA. Transcriptional regulation and its misregulation in disease. Cell 2013;152:1237-51.
6. Wang X, Inoue S, Gu J, Miyoshi E, et al. Dysregulation of TGF-beta1 receptor activation leads to abnormal lung development and emphysema-like phenotype in core fucose-deficient mice. Proc Natl Acad Sci USA 2005;102:15791-6.

Management of ocular manifestations of autosomal recessive congenital ichthyosis 4B, harlequin type, in the perinatal period

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Autosomal recessive congenital ichthyosis (ARCI4B [OMIM #242500]), also known as harlequin ichthyosis, presents at birth with extreme hyperkeratosis and thick-fissured plaques, leading to tightness of the skin around the eyes, mouth, ears, chest, abdomen, and extremities. Ocular manifestations include cicatricial ectropion and exposure keratitis. We present 2 infants with ARCI4B and cicatricial ectropion who were managed with aggressive nonsurgical therapy. Both infants avoided severe ocular sequelae and maintained corneal clarity, highlighting that management of exposure keratopathy with frequent ophthalmic ointment application can prevent severe ocular surface pathology in ARCI4B.

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