Atypical Presentation of Acute Angle-Closure Glaucoma in Maroteaux-Lamy Mucopolysaccharidosis with Patent Prophylactic Laser Peripheral Iridotomy: A Case Report

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ABSTRACT

Introduction: Maroteaux-Lamy syndrome (MLS) is a rare progressive condition characterized by inflammation and scarring of multiple organs. Ocular complications caused by anterior segment abnormalities commonly cause visual impairment in MLS. Angle-closure glaucoma is one such complication, but there are limited data on presentation, workup, and management of this condition.

Case Presentation: This case report describes an atypical presentation of acute angle-closure glaucoma in a patient with MLS despite a prior prophylactic laser peripheral iridotomy—which would typically prevent an acute angle-closure attack—that was patent and intact at the time of angle closure.

Discussion: Because of severe congenital anterior segment crowding, high axial hyperopia, and constant accommodative demand in patients with MLS, we recommend performing two prophylactic laser peripheral iridotomies simultaneously in the same eye instead of one. The mechanism for this indication differs from that in patients at risk of acute angle-closure glaucoma because of lens zonulopathy alone. We hope that this case report may help prevent vision loss and optimize quality of life in patients with MLS who may be wheelchair-bound but are typically high functioning with normal intelligence.

INTRODUCTION

Maroteaux-Lamy syndrome (MLS), known as mucopolysaccharidosis type VI, is a rare autosomal recessive disease caused by a mutation in the *ARSB* gene. This gene encodes an enzyme called arylsulfatase B, which is involved in the breakdown of glycosaminoglycans (GAGs), specifically the GAGs dermatan sulfate and chondroitin sulfate. Mutations in this gene cause absent or reduced arylsulfatase B activity, which leads to an accumulation of GAGs in cell lysosomes and manifests phenotypically as progressive inflammation and scarring of multiple organ systems.[1-4] External features of MLS include macrocephaly, coarse facial features, macroglossia, short stature, and limited joint mobility. Other systemic findings include atlanto-axial instability, meningeal thickening, cervical stenosis, hearing loss, cardiac valve abnormalities, and restrictive/obstructive lung disease, but normal intelligence.[2]

Ocular complications causing severe vision loss are common in patients with MLS. These complications include corneal clouding (GAG deposition in the cornea), retinopathy (GAG accumulation in the retinal pigment epithelium, causing photoreceptor loss), and ocular hypertension/glaucoma caused by either the open-angle (GAG deposition in the trabecular meshwork) or angle-closure type (narrow anterior chamber with thickened cornea and iris).[1] Optic nerve changes, such as optic nerve atrophy, optic nerve swelling, and optic nerve sheath thickening, are also common.[5]

Typically, a single laser peripheral iridotomy is indicated for the pupillary block mechanism of angle-closure glaucoma (ACG). Currently, performing two laser peripheral iridotomies simultaneously is indicated for patients at risk of acute ACG because of lens subluxation causing pupillary block ACG.[6] Although these patients' anatomic risk factors predispose them to a mixed mechanism of ACG, if a patient with mucopolysaccharidosis presents acutely with the pupillary block variety of ACG in the involved eye, we recommend performing two simultaneous laser peripheral iridotomies (LPIs) prophylactically, particularly in patients with MLS, who possess normal intelligence and functional potential.

CASE PRESENTATION

Presenting Concerns

A 37-year-old, wheelchair-bound, 10-diopter (D) hyperopic white woman with MLS documented by arylsulfatase B enzyme assay presented with acute, painful visual decline in her left eye with light perception visual acuity. On presentation, the patient had a history of a patent LPI in each eye and was not receiving any ophthalmic medications. The affected left eye had trace nuclear sclerosis and was notable for acute ACG with an intraocular pressure (IOP) of 60 mmHg.

Records obtained from the patient's local ophthalmologist showed that her IOP in the preceding 8 years ranged from only 10 mmHg to 16 mmHg in both eyes. At 2 months before presentation, best-corrected visual acuity in the affected eye was 20/40 with a manifest refraction of +9.50 + 1.00 × 35. In the other eye, best-corrected visual acuity was 20/25 with a +10.25 lens. The patient reported 6 months of chronically intermittent headaches.

Therapeutic Intervention and Treatment

The patient was treated with maximally tolerated medical therapy using aqueous suppressants as well as oral acetazolamide. Despite the creation of a second LPI in the affected left eye, the patient remained in pupillary block with an IOP of 38 mmHg.

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Table 1. Timeline of events

Date	Event	Relevant ophthalmic examination data[a]	Intervention[b]
Unknown	Bilateral LPI	Unknown	Uncomplicated postoperative course
7/2014	Headaches noticed	IOP OS 10 mmHg	None; good IOP control
1/9/2015	Headaches worsened, visited local ophthalmologist	IOP OS 16 mmHg	No drops
1/20/2015	Painful acute vision loss in left eye	IOP OS unknown	Referred to Ophthalmology
1/21/2015	Patient presented with severe headache	IOP OS 60 mmHg, VA OS LP	Laser PI OS; drops: pilocarpine, acetazolamide, brinzolamide-brimonidine, dorzolamide-timolol
1/22/2015	Persistent headache	IOP OS 38 mmHg, VA OS LP	Surgical PI OS
1/23/2015	Postoperative day 1 after surgical PI, no headaches	IOP OS 21 mmHg, VA OS CF	Continue therapy with acetazolamide, brinzolamide-brimonidine, and dorzolamide-timolol

[a] At the time of the event, before intervention.
[b] "Drops" indicate aqueous suppressant medical therapy.
CF = counting fingers; IOP = intraocular pressure; LP = light perception; LPI = laser peripheral iridectomy; NA = not available; OS = left eye; VA = visual acuity.

A surgical peripheral iridectomy was subsequently performed. The IOP decreased to 21 mmHg, and visual acuity improved to counting fingers. The anterior chamber (AC) deepened, but the view to the optic nerve remained hazy because of corneal edema and chronic corneal clouding. Medical therapy was continued, although pilocarpine treatment was held to avoid miotic-induced AC shallowing.

The patient's postoperative regimen included fluorometholone and 5% sodium chloride drops to facilitate corneal clearing. The timeline of events is summarized in Table 1.

Follow-up and Outcomes

Ancillary testing was performed at the postoperative visit 1 week after completion of iridectomy in the left eye (Table 2). Ultrasound biomicroscopy of the left eye revealed a shallow AC and a thickened cornea with central AC depth of only 0.38 mm, measured as the distance from corneal endothelium to the anterior iris border (Figure 1). B-scan ultrasonography demonstrated a thickened, congested sclera (Figure 2) and axial length of less than 20 mm in both eyes (19.53 mm in the right eye and 19.32 mm in the left eye). The retinal-choroidal-scleral thickness was very high,[7] and there was no evidence of vitreous debris, retinal detachment, or mass or tumor.

As of this writing, the patient uses her right eye to see, has stable IOP control, and is being followed closely for signs of angle closure in the right eye.

DISCUSSION

There are limited data on the presentation, workup, cause, and management of ACG in MLS, but the association has been reported in two studies.[8,9] In 1981, two cases of glaucoma associated with MLS were described by Lloyd-Jones and Hitchings.[8] In 1989, Cantor et al[9] described four patients with MLS who had increased IOP and features of glaucoma. Two of these patients had documented ACG that required surgical treatment. One patient had narrow AC depth peripherally but relatively normal depth centrally. This patient's cornea was too opaque to visualize the angle structures. The last patient had angle closure on gonioscopy.[9]

Possible mechanisms for glaucoma vary. Open-angle glaucoma in mucopolysaccharidosis has been attributed to GAG deposition in the trabecular meshwork.[10] With ACG, intracellular and extracellular GAG accumulation has been linked to thickening of the cornea and other anterior segment structures.[11] Specifically, GAGs are deposited in the intracytoplasmic vacuoles of macrophages in the Bowman layer, corneal stromal keratocytes, ciliary body stroma cells, and intracanalicular connective tissue cells of the trabecular meshwork, as well as extracellularly around the stromal keratocytes.[12] In addition, the constant accommodative demand from high hyperopia shifts the lens-zonule plane anteriorly and increases the risk of ACG. Across different types of glaucoma, optic neuropathy may occur secondary to GAG accumulation in ganglion cells and optic nerve compression caused by thickening of the optic nerve sheath and sclera.[1]

In our patient, after surgical iridectomy to treat the pupillary block component of acute ACG, the plan was to proceed with cataract extraction and lens insertion, primary posterior capsulotomy with anterior vitrectomy, and a glaucoma drainage device to treat the remaining components of ACG. A prophylactic second LPI was also performed in the contralateral eye because of the risk of acute ACG in the setting of shallow AC depth and high hyperopia. Potential challenges to additional surgery involved the patient's medical comorbidities (tracheostomy and multiple cardiac valve abnormities) as well as surgical positioning of the patient: a posterior cervical fusion had been performed for spinal cord decompression. Furthermore, the patient's extreme axial hyperopia increased her risk of aqueous misdirection or choroidal effusion and necessitated trimming of the posterior plate of the glaucoma drainage device because short axial length increased the risk of optic nerve touch.

Table 2. Patient parameters at 1-week postoperative visit

Parameter	Measurement
Anterior chamber depth, mm	OD: 1.19, OS: 0.38
Axial length, mm	OD: 19.53, OS: 19.32
Average keratometry, diopters[a]	OU: 43.50
Central corneal thickness, µm[b]	OD: 565, OS: undetectable because of corneal edema
Retinal-choroidal-scleral thickness, mm[c]	OS: 2.3

[a] Average keratometry measurement obtained using a manual keratometer.
[b] Central corneal thickness from a handheld pachymeter (Pachmate DGH 55, DGH Technology Inc, Exton, PA).
[c] Normal retinal-choroidal-scleral thickness is 1.3 mm.
OD = right eye; OS = left eye; OU = both eyes.

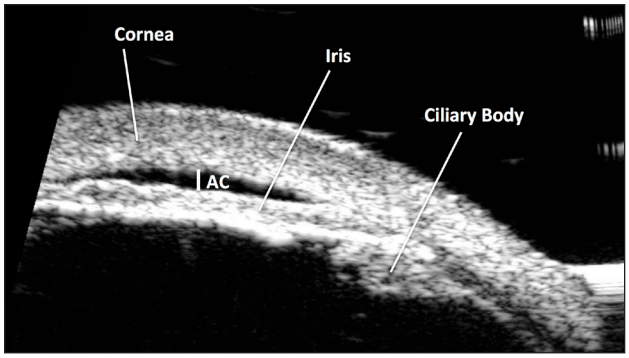

Figure 1. Ultrasound biomicroscopic image of the left eye. The cornea, iris, and ciliary body can be seen. The anterior segment is notable for angle closure with a shallow anterior chamber (AC) measuring 0.38 mm centrally.

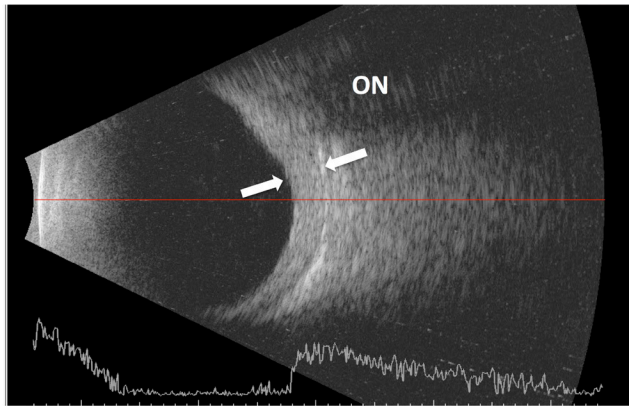

Figure 2. B-scan ultrasound image of the left eye. The white arrows indicate the thickened and congested choroid and sclera. The axial length is short, measuring 19.32 mm.

ON = optic nerve.

After being told the surgical risks, benefits, and alternatives, the patient elected not to proceed with the surgical plan. She cited the risks of anesthesia and surgery with her medical comorbidities, the fact that she was already 37 years old and her sister had died of MLS at age 33 years, and the fact that the affected eye had poor visual potential. At the time of this writing, our patient is functioning visually, using her right eye, with stable IOP control and no signs of angle closure.

CONCLUSION

This article presents a case report of an atypical presentation of acute ACG. Typically, angle closure despite a patent LPI is suggestive of plateau iris syndrome, iris bombé from encircling posterior synechiae, or lens subluxation. With an underlying diagnosis of MLS, this patient was predisposed to extreme pupillary block ACG because of congenital anterior segment crowding. Classically, performing two LPIs simultaneously in the same eye—at the 9-o'clock and 3-o'clock locations—has been considered for patients at risk of acute angle closure caused by lens subluxation. We present an example of a patient with MLS who would benefit from the same procedure with a different mechanism instead of lens subluxation: Pupillary block resulting from extreme axial hyperopia. Although an iridotomy is theoretically limited to treating only the pupillary block mechanism of angle closure and may not be effective in a patient with multiple angle-closure mechanisms, the fact that an acute surgical iridectomy was effective for this patient suggests that pupillary block was the overriding pathophysiology for angle closure. Therefore, performing 2 LPIs in the same eye as prophylaxis might be helpful for patients with similar ocular anatomy.

Despite having multiple medical comorbidities and limited mobility, patients with MLS are high functioning with normal intelligence and depend highly on their vision. We recommend consideration of this preventive modality for all patients with mucopolysaccharidosis to optimize the preservation of their quality of life. ❖

Disclosure Statement

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