Cyclodialysis cleft repair with goniotomy for the control of post-operative ocular hypertension

Lorraine M. Provencher\textsuperscript{a,b,*}, Manjool M. Shah\textsuperscript{a}

\textsuperscript{a} University of Michigan, Kellogg Eye Center, Ann Arbor, MI, USA
\textsuperscript{b} Cincinnati Eye Institute, Cincinnati, OH, USA

ARTICLE INFO

Keywords: Cyclodialysis cleft Ocular hypertension Glaucoma Minimally invasive glaucoma surgery MIGS

ABSTRACT

Purpose: In this case of iatrogenic cyclodialysis cleft, we describe a technique in which a nasal goniotomy is coupled with indirect cyclodialysis cleft (CDC) repair in order to minimize acute post-operative ocular hypertension, which is common following cyclodialysis cleft closure.

Observations: This novel technique was simple, convenient, and effective in controlling intraocular pressure (IOP) for the patient.

Conclusions and importance: IOP frequently spikes to dangerously high levels following CDC closure. Pairing CDC repair with goniotomy may help prevent acute post-operative ocular hypertension in these patients.

1. Introduction

Acute intraocular pressure (IOP) rise following spontaneous\textsuperscript{1,2} or planned\textsuperscript{3–5} cyclodialysis cleft (CDC) closure is a well-described phenomenon. In patients undergoing surgical CDC repair, the incidence of an IOP spike ranges from 47 to 83%, with IOP rising to dangerously high levels of 50–70 mmHg in the early post-operative period.\textsuperscript{1,3–5} The mechanism for post-closure ocular hypertension remains uncertain, but it may result from a collapsed or fibrotic conventional outflow system accustomed to prolonged hypotony, which then fails to accommodate aqueous production after CDC closure.\textsuperscript{6,7} Most patients do not experience ongoing ocular hypertension, which argues against fibrosis as a mechanism.

Though small clefts may close with more conservative medical or laser therapies, surgical repair is often necessary for clefts larger than 2 clock hours.\textsuperscript{4,5} Now, in the era of minimally invasive glaucoma surgery, it is reasonable to consider a concurrent angle-based IOP lowering intervention at the time of surgical cleft closure. We describe a case of indirect CDC repair paired with goniotomy in order to decrease resistance in conventional outflow by removing trabecular tissue and to mitigate an anticipated post-operative IOP spike. To the best of our knowledge, this is the first description of pairing CDC closure with goniotomy.

2. Case report

An 80-year-old female presented to her local emergency department with one day of clouded vision and pain OD, along with nausea. IOP was 72 mmHg OD. She received 50 g 20% mannitol intravenously and several doses of topical pilocarpine (concentration unknown) prior to transfer.

Upon arrival to our institution, vision had improved, and her eye pain and nausea had resolved. Based on outside records, she had a history of mild primary open angle glaucoma OU status post argon laser trabeculoplasty OU. Three years ago, she underwent phacoemulsification with intraocular lens and trabecular microbypass stent (iStent, Glaukos Corp, San Clemente, CA) placement OU. Her post-operative course was complicated by persistent hypotony and blurred vision OD (IOP 2-6 mmHg, best-corrected distance visual acuity 20/30 - 20/40) due to a nasal CDC, which likely occurred at the time of iStent placement. Her iStent had been removed 5 months prior in an attempt to raise her IOP, but best-corrected distance visual acuity was 20/40 OD and IOP remained 6 mmHg OD at her last local follow-up 3 months ago.

Corrected visual acuities were 20/25-2 OD, 20/25-2 OS. IOPs were 7 mmHg OD and 10mmHg OS. Her right pupil was 1.5 mm and non-reactive due to recent pilocarpine use. Her left pupil was normal. There was no APD. Her iridocorneal angles were grade III OU with a gaping 2-clock hour CDC nasally OD. She had trace corneal edema and trace anterior chamber cell OD, along with posterior chamber...
intraocular lenses OU. Her optic nerves appeared healthy with cup-to-disc ratios of 0.6 OU. Ultrasound biomicroscopy confirmed the presence of a cleft (Fig. 1A), along with a shallow 360-degree ciliary body detachment (Fig. 1B).

The patient was diagnosed with late, spontaneous CDC closure OD, which likely reopened after pilocarpine. Pilocarpine was discontinued, and the cleft remained large 1 week later. In order to prevent future spontaneous closure and an uncontrolled IOP spike, indirect CDC repair was recommended with concurrent goniotomy. Indirect CDC repair was utilized over direct in order to minimize scleral dissection in this pseudophakic patient with easy access to the ciliary sulcus. Surgical closure would allow for CDC closure and monitoring in a controlled, timed setting. Special institutional approval was not required for her surgical plan, as both goniotomy and cleft repair are routinely performed at our institution.

3. Technique (Video 1)

A small nasal peritomy was created. An Ahmed indirect gonioprism was used to inspect and externally mark the extent of the CDC. A clear corneal wound was created. Healon GV was used to inflate the nasal ciliary sulcus. Both arms of a double-armed STC-6 10-0 prolene needle were placed through the temporal wound, into the sulcus, and out through the sclera posterior to the scleral spur at 2:30 and 3:30. The prolene was tied and rotated into sclera. The patient’s head and microscope were turned to facilitate direct gonioscopy. Healon GV was placed in the nasal iridocorneal angle. Using a Swan-Jacobs style gonioprism, a small residual CDC was noted around 1:30. A bent-tip 25-gauge needle was used to create a 2.5-clock hour nasal goniotomy (Shute TS et al. American Glaucoma Society 2019;29; Abstract 16). The trabecular meshwork strip was removed with microforceps. The peritomy was enlarged and an additional 10-0 prolene suture was placed to complete closure of the CDC. Healon GV was then irrigated from the eye. The peritomy was closed with vicryl suture. Oral acetazolamide 500 mg was given in the post-operative holding area. She was placed on prednisolone acetate 1%, ofloxacin 0.3%, dorzolamide 2%, timolol 0.5%, and brimonidine 0.2%.

4. Results

At post-operative day 1, IOP was 45 mmHg but stabilized in the mid-twenties after anterior chamber paracentesis and 250 mg acetazolamide, which was continued BID. Over the course of the next 2 months (Fig. 2), the patient was tapered off of all medications aside from timolol 0.5% BID. At last follow-up (post-op month 2), corrected visual acuity was 20/20 and IOP was 10 mmHg. The CDC remained closed.

5. Discussion

Our patient presented with a symptomatic and severe IOP spike >70 mmHg due to late spontaneous closure of an iatrogenic CDC, which likely occurred at the time of iStent placement. The cleft recurred with pilocarpine administration by a non-ophthalmologist. Surgical repair was indicated due to the size of the cleft and the risk of hypotony or recurrent uncontrolled spontaneous CDC closure. With strong evidence that IOP would spike again with surgical closure, goniotomy was

Fig. 1. Ultrasound biomicroscopy demonstrating (A) a focal nasal cyclodialysis cleft and (B) a shallow ciliochoroidal detachment.

Fig. 2. The patient’s IOP course from spontaneous cleft closure (green arrow) to last follow-up. She had a blunted IOP spike following CDC repair with goniotomy (surgery day = red arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
performed at the time of CDC repair in an attempt to minimize resistance with the restoration of conventional outflow.

An IOP spike was detected on post-operative day 1 but was less severe compared to her initial spontaneous IOP spike. This blunted IOP rise may have been due to residual resistance in the post-trabecular aqueous collector channels, a finding supportive of conventional outflow collapse as a mechanism for post-closure ocular hypertension. Following her limited spike, IOPs remained stable near episcleral venous pressure.

6. Conclusion

CDC repair with concurrent goniotomy is a low risk, 8,9 convenient, and effective means of mitigating post-operative IOP fluctuation following CDC closure. To the best of our knowledge, this is the first description of pairing CDC closure with goniotomy. This technique may prove particularly useful in patients, regardless of the etiology for CDC, with severe stage glaucoma that may be intolerant to an IOP spike or in patients without quick access to ophthalmic or emergency care. Iatrogenic clefts are likely to increase in the era of minimally-invasive glaucoma surgeries (MIGs) as more surgeons attempt to intervene in the iridocorneal angle. Improved techniques for both the intraoperative and post-operative management of these patients will become crucial.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

Funding

No funding or grant support was required for this work.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

The authors have the following financial interests to disclose, none of which are relevant to this work:
- Dr. Provencher: IDx LLC, (consultant).
- Dr. Shah: Glaukos (consultant, speaker), Allergan (consultant, speaker), Katena. (consultant).

Acknowledgements

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2020.100781.

References

1. Mustafa OM, Yassine DJ. Delayed spontaneous closure of postsurgical cyclodialysis cleft. Int Ophthalmol. 2018;38(1):1-2.
2. Aminlari A, Callahan CE. Medical, laser, and surgical management of inadvertent cyclodialysis cleft with hypotony. Arch Ophthalmol. 2004;122(3):399–404.
3. Agrawal P, Shah P. Long-term outcomes following the surgical repair of traumatic cyclodialysis clefts. Eye. 2013;27(12):1347–1352.
4. Kuchle M, Naumann GO. Direct cycloplexy for traumatic cyclodialysis with persisting hypotony. Report in 29 consecutive patients. Ophthalmology. 1995;102(2):322–333.
5. Popovic M, et al. Cyclodialysis cleft repair: a multi-centred, retrospective case series. Clin Exp Ophthalmol. 2019;47(2):201–211.
6. Shaffer RN, Weiss DI. Concerning cyclodialysis and hypotony. Arch Ophthalmol. 1962;68:25–31.
7. Ormerod I, Baerveldt G, Green R. Cyclodialysis clefts: natural history, assessment and management. In: Weinstein G, ed. Open-Angle Glaucoma. New York: Churchill Livingstone; 1986:201–225.
8. Berdahl JP, et al. Six-month outcomes of goniotomy performed with the kahook dual blade as a stand-alone glaucoma procedure. Adv Ther. 2018;35(11):2093–2102.
9. Dorairaj SK, et al. 12-Month outcomes of goniotomy performed using the kahook dual blade combined with cataract surgery in eyes with medically treated glaucoma. Adv Ther. 2018;35(9):1460–1469.