

Update on Glaucoma Following Cataract Surgery (GFCS)

By,

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Introduction

- Glaucoma following cataract surgery (GFCS), previously termed as aphakic and/or pseudophakic glaucoma, is a serious and sight-threatening postoperative complication of pediatric cataract surgery.
- Based on the Childhood Glaucoma Research Network (CGRN), GFCS is secondary glaucoma that meets glaucoma definition after cataract surgery is performed.

- *Beck A, Chang TC, Freedman S. Section 1: definition, classification, differential diagnosis. In: Weinreb RN, Grajewski A, Papadopoulos M, et al, eds. World Glaucoma Association Consensus Series-9: Childhood Glaucoma. Amsterdam, The Netherlands: Kugler Publications; 2013:3–10.*

Incidence

- The incidence of GFCS has been reported to range between 2% and 32% according to different studies, with large variation within the literature due to:
 - The population being studied.
 - The technique being used
 - Lack of specific definitions and diagnostic criteria
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- *Abdelmassih Y, Beaujeux P, Dureau P, et al. Incidence and risk factors of glaucoma following pediatric cataract surgery with primary implantation. Am J Ophthalmol. 2021;224:1–6.*

Mechanisms

- 1. **Open-angle glaucoma** is now the most common type of glaucoma occurring after congenital cataract surgery. The Infant Aphakia Treatment Study (IATS) reported that 19 of 20 eyes that developed glaucoma had OAG.
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- *Freedman SF et al. JAMA Ophthalmol. 2015 ;133 (8) : 907-914.*

Mechanism

- **2. Angle-closure glaucoma.**
- When **earlier needling** techniques were used to remove congenital cataracts, angle-closure glaucoma was the most common type seen in this setting.
- **Pupillary-block glaucoma** after IOL implantation in children.
- There may be anatomical changes to the angle or malpositioning of the iris revealed high iris insertion denoting the importance of **routine gonioscopy** and sometimes UBM might also be indicated
- **3.** In addition, **steroid medications** used in connection with cataract surgery are another cause of IOP increase. Children are more susceptible to steroid-induced ocular hypertension, which often has a rapid onset and is more aggressive than in adult
- *Balekudaru S, Agarkar S, Guha S, et al. Prospective analysis of the predictors of glaucoma following surgery for congenital and infantile cataract. Eye. 2018;33(5):796-803.*

Pathogenesis

- The pathogenesis is thought to be multifactorial .Theories suggest a **mechanical** loss of support to the trabecular meshwork (TM) after a lensectomy, in addition to the **chemical** alteration of the TM morphology and gene expression due to inflammatory mediators from the vitreous cavity.
- Other studies have described **post-operative TM obstruction** and anterior chamber fibrosis from residual lens material and synechiae formation.
- *Yeung HH, Kumar-Singh R, Walton DS. Infantile Aphakic Glaucoma: A Proposed Mechanism. Journal of Pediatric Ophthalmology & Strabismus. 2022 Jul 1;59(4):236-42.*

Childhood Glaucoma Research Network (CGRN) Diagnostic Criteria

CGRN diagnostic criteria are preferable for GFCS because they emphasize the signs of glaucoma and visual field defects other than IOP, which may help avoid unnecessary treatment and missed diagnosis.

2 or more of the following are required:

1. **IOP >21 mm Hg** (investigator discretion on the method of measurement and if data obtained during examination under anesthesia alone are sufficient).
2. **Visual fields**: reproducible visual field defect that is consistent with glaucomatous optic neuropathy with no other observable reason for the visual field defect.

3. **Axial length**: progressive myopia or myopic shift with increased ocular dimensions that outpace normal growth.

4. **Cornea**: findings that include Haab striae, corneal diameter >11 mm in newborns, >12 mm in children younger than 1 year, and >13 mm in children older than 1 year.

5. **Optic nerve**: progressive increase in cup-to-disc ratio, cup-to-disc asymmetry ≥ 0.2 and focal rim thinning.

Thau A, Lloyd M, Freedman S, et al. New classification system for pediatric glaucoma: implications for clinical care and a research registry. Curr Opin Ophthalmol. 2018;29:385–394.

Risk factors

- Numerous studies have proposed **various risk factors** for GFCS including:
 - Age at lensectomy,
 - IOL implantation,
 - Type of cataract,
 - Primary posterior capsulotomy with anterior vitrectomy,
 - Preexisting ocular abnormalities (microphthalmia, microcornea, persistent fetal vasculature, etc.),
 - Additional intraocular surgery, and
 - Family history of congenital cataract or GFCS.
- *Solebo AL, Rahi JS. British Congenital Cataract Interest G. Glaucoma following cataract surgery in the first 2 years of life: frequency, risk factors and outcomes from IoLunder2. Br J Ophthalmol. 2020;104:967–973.*

Age at Lensectomy

- Most published studies have found that early age at lensectomy is a risk factor for GFCS, especially in the first 3 months of life. .
- The increased risks of GFCS after early lensectomy must be balanced against the need to decrease the period of visual deprivation, particularly because form-deprivation amblyopia is generally more difficult to treat than glaucoma.
- *Eibenberger K, Kiss B, Schmidt-Erfurth U. et al. Clinical characteristics and treatment of secondary glaucoma, glaucoma suspects and ocular hypertension after congenital cataract surgery. Eur J Ophthalmol. 2021;31:3309–3317.*

IOL Implantation

- Some studies suggest that primary IOL implantation may reduce the risk of GFCS, whereas others do not confirm this result. However, some prospective studies have indicated that primary IOL implantation does not protect against GFCS.
- Regarding this **controversial** issue, 2 meta-analyses have found that primary IOL implantation was correlated with a significantly **lower risk** for postoperative GFCS development. Possible reasons for this include the fact that IOL could prevent TM collapse and isolate the TM from the vitreous, as the vitreous could cause a toxic reaction when it contacts TM.
- *Zhang S, Wang J, Li Y, et al. The role of primary intraocular lens implantation in the risk of secondary glaucoma following congenital cataract surgery: a systematic review and meta-analysis. PLoS One. 2019;14*

Associated Ocular/Systemic Anomaly

- Some infant patients with congenital cataracts have associated ocular anomalies, such as persistent fetal vasculature, microphthalmia, microcornea, etc, may be risk factors for the development of glaucoma.
- *Traboulsi EI, Vanderveen D, Morrison D, et al. Associated systemic and ocular disorders in patients with congenital unilateral cataracts: the Infant Aphakia Treatment Study experience. Eye (Lond). 2016;30: 1170–1174.*

Family History

- Some studies have proposed that a family history of congenital cataract, congenital glaucoma, and GFCS in their first-degree relatives is a risk factor for GFCS however, the mechanism has not been elucidated to date.
- *Wang JCJ, Chen W, Wang Q, et al. Incidence of and risk factors for suspected glaucoma and glaucoma after congenital and infantile cataract surgery: a longitudinal study in China. J Glaucoma. 2020;29:46–52.*

Treatment

- Treating GFCS remains a **major challenge** in the postoperative population with pediatric cataracts.
- **Medication** is usually the first-line treatment for open angle GFCS, both as a preoperative temporizing measure to control IOP or as adjuvant therapy after the partial success of surgical treatment.
- Notably, among these topical IOP-reducing medications, **alpha-adrenergic** (i.e., brimonidine) should not be used in children aged younger than 6 years and weighing <20 kg. due to their potentially life-threatening side effects, including central nervous system and respiratory depression.
- *Al-Shahwan S, Al-Torbak AA, Turkmani S, et al. Side-effect profile of brimonidine tartrate in children. Ophthalmology. 2005;112:2143.*

Treatment

- **Surgical intervention** is indicated when IOP cannot be controlled with medication or when compliance is poor.
- According to the literature, **36.4% to 57.1%** of patients with GFCS require surgical treatment.
- Various surgical procedures have been reported to treat GFCS, including **traditional glaucoma surgery** and Minimally invasive glaucoma surgery (**MIGS**). The former includes conventional trabeculotomy, trabeculectomy, CTT (with antimetabolites), GDD implantation, and cyclodestructive procedures.
- *in the first year after pediatric lensectomy. JAMA Ophthalmol. 2020;138:71–75. Freedman SF, Kraker RT, Repka MX, et al. Incidence and management of glaucoma or glaucoma suspect*

Suggested flowchart for the surgical management of pediatric GFCS with open-angle.



