Pediatric Cataract Follow up and Indications for Surgery

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Congenital and Early Developmental Cataract are common ocular abnormalities

- Prevalence is about 1 of every 250 (0.4%) newborns
- Important cause of visual impairment in childhood
- 10 to 38% of Causes of all blindness in Children
- Only 26% of those children operated for congenital cataract were able to attend an ordinary school
Indications for Treatment

Any Pediatric Lens opacity (cataract) needs management:
- Concomitant ocular developmental defects (potential for vision):
  * Anterior segment
  * Posterior segment

Systemic disease
- Severity of lens opacity: size, shape, location
- Severity of visual disturbance attributed to lens opacity
- Existance and management of refractive error(s)
- Amblyopia and its management
- Latency interval: from diagnosis to management
Decision Making for Surgical Management

Simple cases:
* Large, dense lens opacities, proximity to posterior lens
* Definite interference with normal visual development

Intermediate and Complex Cases:
* Moderate lens opacities
* Co-existance of refractive errors, amblyopia
* No Nystagmus
* Usually “second-opinion” needed
Intermediate- Case
Decision- Making

- Visual and functional performance
- Poor retinoscopic (red) reflex
- Central lens opacity >3mm
- Poor Retina visualization with direct ophthalmoscope
- Presence of Relative APD: poor prognostic sign
- Progression of the lens opacity
Intermediate - Case
Decision - Making ... cont

- Unilateral Congenital cataracts (vs. bilaterality)
- Delayed diagnosis: due to contralateral normal eye
- Associated Ocular Defects: Microphthalmos, Foveal Dysplasia, Strabismus (in 30-70% of cases)
- Postoperative enlargement of Peripheral Field of vision
- BCVA <20/70 in involved eye
- Mydriatic- Cycloplegic drops:
  - If lens opacity mild and central
  - Photophobia aggravated
  - Reading glasses: often necessary
Incision Construction in Pediatric Cataract Surgery
Applied Anatomy of Child’s Eye

- Cornea in Premature and Full-term babies: Thick
- Thickness Reaches adult level in 2-4 years
- Sclera: Low Rigidity, Not so thick
- Anterior chamber: Shallower than adult
- Astigmatism:
  - * Higher prevalence of ATR during infancy
  - * Prevalence of WTR astigmatism increases with age
Incision Architecture
Incision Location

Superior approach:
- More protection by Brow, Bell’s phenomenon
- Easily made: children rarely have deep set orbits or overhanging brows
- Location of choice by 84% of AAPOS members
Location...(2)

Steepest Meridian:
- Decreases Surgically Induced Astigmatism
- Difficult in children:
  * Preoperative Refractive Exam: Difficult
  * Hand-held Keratometers: reliable?
  * Topography: Difficult Cooperation and Fixation
- Changes with growth

Temporal
- More Trauma Exposed
**Incision Construction**

**Scleral vs Corneal Incision**

**Advantages:**

* Avoid Conjunctival Peritomy, Cauterization
* Avoid occasional Hyphema
* Ease of Intraoperative maneuvering
* Better Cosmesis
* Future Filteration surgery: better outcome
* Indicated in eyes receiving anticoagulant therapy
* Decreased early postoperative breakdown in blood – aqueous barrier
Disadvantages of Corneal Incision

- Higher rate of Surgically Induced Astigmatism
- Poor Wound Stability, especially if incision is larger
- Increased risk of Endophthalmitis: probably less in children due to suturing
- Higher rate of Endothelial Cell Loss
- Delayed healing compared to Scleral incision
Scleral vs Corneal Incision

- Only 38% ASCRS and 27% AAPOS respondents prefer Corneal Tunnel Incision
- Opacification at site of corneal incision
- For rigid PMMA-IOL’s Scleral tunnel preferred
- When IOL type (Rigid vs Foldable) Not certain e.g. in eyes with trauma or lens subluxation
- In the case of Pars Plana Vitrectomy + Posterior capsulotomy: Scleral Tunnel preferred

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Shape of the Incision

- All types of Scleral incisions are widely used

- Straight, Frown, Circumlimbal types are acceptable
Paracenthesis Incisions

Useful for:
1. Performing bimanual maneuvers (I/A, Cutting)
2. Intraocular solution injection, Ophthalmic Viscoelastic
3. Globe Stabilization
4. Controlling the Movement of instruments
5. Facilitating Lens implantation
6. Facilitating the use of iris retractors
Paracenthesis

**Location:**
- 2 and 10 O’clock: for bimanual maneuvering
- or 70° to left of Primary incision

**Length:**
- ~1.0mm, Tunnel shaped, not true “stab”

**Width:**
- 1mm, 20-gauge MVR (0.9mm) opening for 20-gauge Vitrector function
Surgical Technique

Conjunctival Opening

- Scleral tunnel: 6-7mm, Fornix-based
- Cauterization: Mild, bipolar (with Eraser tip)
- Heavier for Posterior vessels going toward incision
Groove
- Desired width: According to IOL type
- Depth: 1/3 to 1/2 Scleral Thickness, Perpendicular

Dissection:
- Half Scleral Thickness, bevel-up Crescent blade
- Superficial dissection: fragile flap
- Deep dissection: risk of premature entrance
Anterior Chamber Entry

- Use 3.2mm sharp Keratome
- Angle of enterance 45°
- Used for Capsulorrhexis forceps, I/A, IOL implantation

Enlargement: according to IOL type & size
Suturing

- Tunnel incisions in Children Leak → needs suturing
- Only 2-8% of AAPOS responders left incision unsutured
- More frequent steroid use in children postpones healing
- Uncooperative postop child: Leakage can not be checked
- Self-sealing wounds fail to remain watertight in children <11yr
Capsule Management in Pediatric Cataract Surgery
Why Anterior Capsulorrhexis is difficult in Children?

- Extreme Elasticity of anterior capsule, Higher Fracture Toughness
- Positive Vitreous pressure, reduced Scleral Rigidity
- Difficult Visualization of capsule
- Sometimes: poor Mydriasis
- More tendency for capsulorrhexis extension: “Runaway Rhexis”
Techniques for Pediatric Capsulotomy

- Manual Continuous Curvilinear Capsulorrhexis (CCC)
- Can-Opener Anterior Capsulotomy
- Vitrectorrhexis (Vitreector Cut anterior capsulotomy)
- Bipolar radio-frequency Capsulotomy
- Fugo plasma blade Anterior Capsulotomy

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How to Create an intact Manual CCC in Pediatric eyes?

- Use a High MW-OVD (Healon GV, Healon5): to push anterior capsule back, **Deepening anterior chamber**
- Aim to make a **Slightly smaller CCC**
- Frequently release capsular flap to see size, shape and direction
- **Regrasp near the site of CCC**, readjust the direction
- Repeat OVD injection to keep AC deep with capsule laxity
- **Irrigation/ Aspiration of lens material reduces intralenticular pressure**

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Can-Opener Anterior Capsulotomy

- Some surgeons perform due to difficult CCC
- Can-opener Capsulotomy may have few radial tears due to Highly elastic capsule
- IOL will move outside of bag when Capsular Contracture occurs
- Decentration rate is higher in can-opener eyes than CCC
Vitrector-Cut Anterior Capsulectomy

(Vitrectorrhexis)

- Comparable be CCC, Visualization is excellent
- Easier to perform in Children, better control
- Vitrector entered through paracenthesis or main incision
- Cut rate 150-300 cycle/min, Aspiration 150-250 mmHg
- Continuous capsule opening at the same time cortex removal
- Low rate of radial tear formation
- Scalloped edges roll outside, not predispose to radial tear
Points to Create a successful Vitrectorrhexis

- Paracenthesis Ports must have minimal leakage
- Venturi Pump of vitreector is preferred to peristaltic type
- Do not start with Bent-needle or cystotome
- Place vitreector touching anterior capsule: first aspiration
- After engagement of capsule activate Vitreector
- Do not leave right-angle edge; Predispose to radial tear
Bipolar Radiofrequency Capsulotomy (Kloti)

**Kloti device** cuts the anterior capsule with platinum alloy-tipped
- Probe: * High frequency current 500 KHz
  * Generated heat: 160°
  * Under Viscoelastic
- Cut edge is less elastic than comparable CCC edge
- Higher risk of radial tear formation

**Fugo plasma blade anterior capsulotomy**
- Rapid cutting (<10sec), needs no red reflex
- Edge not more resistant than the Kloti diathermy

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Posterior Capsulotomy and Anterior Vitrectomy for the Management of Pediatric Cataract Surgery
When Posterior Capsulotomy is Indicated?

- One of the most common and controversial questions.
- All the cataract surgeries under the age 6 years (8 even 10?)
- Condition of the Posterior Capsule (Dense opacification, Plaque)
- Poor cooperative child for YAG capsulotomy, unavailable vertical-mounted YAG lasers.
Why “posterior capsulotomy+Anterior vitrectomy” is indicated?

- High rate (~ 100%) of PCO and fibrosis in children under 6 years of age 18 mo to 2 years after surgery
- PCO and Visual axis opacification (VAO) are amblyogenic
- Dense VAO will need repeated YAG (?) or intraocular surgeries

- Anterior Vitreous Face(AVF):
  * Closely linked to posterior capsule
  * More”reactive” in infants

* Scaffold for lens epithelial cells, metaplastic pigment epithelial cells, exudates, cells, fibrous membranes
Primary Capsulotomy vs. Secondary

- More controllable capsulotomy as Primary
- Removal of Anterior Hyaloid Face (as scaffold of recurrent opacification in Primary Capsulotomy)
- Lower Risk of CME, and RD in primary procedures
- Management of secondary opacifications may be more troublesome and difficult, more complicated more risk of intraocular structure trauma
Nd-YAG Laser Capsulotomy in Children

- First choice in adult PCO
- Repeated sessions needed in children
- May require general anesthesia with vertical mounted YAG which is not available
- High recurrence rate for membrane formation and opacification
- Increased risk of IOL trauma with laser
- Many of YAG capsulotomy tried in Children will need Secondary Operations
Techniques for Posterior Capsulotomy

- Manual Posterior Capsulorrhexis (PCCC)
- Vitreector Assisted Capsulotomy
- Radiofrequency diathermy
Anatomic differences between Anterior and Posterior Capsule

Posterior Capsule:
- 3 to 5 times thinner (4-9μ), minimal changes with aging
- Decreased Mechanical Strength with aging
- Decreased Extensibility by a factor of two
- Decreased force of breakage by a factor of five
Characteristics of Posterior Capsulotomy

- **Size:** Goal 3.5-5.0 mm
- **Small opening** → Phymosis Contracture → Closure by inflammatory membrane
- **visual axis opacity** → Need for secondary surgery
- **For Optic Capture:** 1-1.5mm smaller than optic
- **Position:** Central Rhesis
- **Shape:** ideal is Circular
Technique of Posterior Capsulorrhexis

- Fill A/C and lens bag with OVD after removal of lens material
- Ideal OVD: high viscosity sodium hyaluronate
- Initiation: central puncture with Cystotome tip → a small flap is formed in Posterior Capsule
- Visco-dissection of Posterior Capsule from AHF push Vitreous Posteriorly
- Flattening of posterior capsule by viscoelastic injection over it
- Posterior capsulorrhexis with forceps
Posterior Capsulotomy + Anterior Vitrectomy after IOL Implantation

Advantage:
- In-the-bag fixation of IOL: More Safe
- Less stressful PCIOL fixation
- Larger Capsulotomy size

Disadvantage:
- After IOL implantation Pars Plana approach is used but limbal is also possible
- Fibrin formation more common
- In-the-bag fixation of IOL more difficult before Vitrectomy
Anterior Vitrectomy

**Route:**
- Trans Limbal: after Posterior Capsulotomy
- Trans Pars Plicata or Pars Plana with Capsulotomy

**Scleral Entrance:**
- <1 years old: ≤2mm Posterior to limbus
- 1-4 yrs: 2.5mm Posterior to limbus
- >4 yrs: 3mm Posterior to limbus
Anterior Vitrectomy

**Goal:**
- Removal of Central Anterior Vitreous
- No attempt for removal of peripheral or Posterior Vitreous

**Setting:** Different Vitrectors variable:
* Cut 350-500/min,
* Suc 60- 100mmHg,
  AFR 20ml/min
Conclusion

Anterior and Posterior Capsular Surgery and Anterior Vitrectomy are essential steps in surgical management of Pediatric Cataracts

Delicate and accurate performance of these steps guarantees lower complication rates, in-the-bag fixation of IOL and long-term clarity of media
Thank You for Your Kind Attention!!