Management of the subluxated cataract

Subluxation of lens signifies partial displacement of crystalline lens or cataractous lens from its central position in the pupillary area. Zonular compromise complicates every step of cataract surgery and poses a serious challenge in terms of safety and visual outcome.

CLINICAL EVALUATION

The clinical evaluation of the subluxated lens patient begins with an appropriate history, which should include family history, relevant trauma, and onset and types of visual symptoms. Comprehensive preoperative examination is necessary to increase the chances of surgical success.

a) The surgeon should make a note of the ‘area of zonular weakness “ by drawing it.

b) Gonioscopy should be performed in older children to access for angle recession, synechia etc if ACIOL implant is considered. Patients should be counselled with regards to a sutured PCIOL / or a CTR.

c) The presence of comorbid conditions affecting visual outcome should be assessed.

d) Evaluation by internists to rule out systemic associations is also necessary.

e) Discontinuing oral anticoagulants as most if these patients have asso cardiovascular diseases and may be on anticoagulant therapy.

Timing of surgery is critical and is governed by the amount of subluxation. Children who are in their visually formative years, need early surgery if they have a large amount of subluxation. Early surgery and visual rehabilitation prevents development of amblyopia or permits early initiation of amblyopia therapy.

Management of Subluxated Cataract

Lens extraction via a small incision PE and PCIOL implantation should be attempted in every case and the basic surgical principles are described below.

Surgical principles to be understood include

1. Incision should be placed away from area of zonular weakness to help reduce stress on the existing zonules during PE. Unfortunately majority of the patients have generalized zonular weakness. In this situation the surgeon should place the incision in the gradient opposite to the zone of maximum zonular weakness However, the surgeon should not jeopardize his surgical ability by operating in a meridian he is uncomfortable with.

2. Surgeon should work through the smallest incision possible without compromising the ability to perform necessary manoeuvres. This will minimize fluid egress through the incision and prevent anterior chamber collapse. The initial AC entry should be just large enough to introduce a visco cannula.

3. A generous amount of highly retentive viscoelastic is placed over the area of zonular dialysis to help tamponade the vitreous and to maintain a deep non collapsing AC.

4. The capsulorhexis is started in an area remote from the dialysis to help utilize the counter acting forces of the remaining healthy zonules.

5. A second instrument is used for counter traction or to push the lens into view if it is significantly decentered under the iris.

6. When there is extensive zonular loss or weakness it may be a good strategy to start the rhexis by cutting the anterior capsule with a sharp tipped blade.

7. A rhexis of 5.5 mm – 6mm will facilitate all manipulations of the nucleus.

8. Hydrodissection: should be performed carefully yet thoroughly to maximally free the nucleus thereby decreasing zonular stress while manipulating the nucleus.

9. A soft nucleus can be completely prolapsed into the anterior chamber to simplify removal and virtually eliminate all zonular stress.
10. Phacoemulsification should be performed using low vacuum and aspiration settings in order to keep the bottle height at a minimum, a technique known as ‘slow-motion Phaco’ developed by Robert Osher.

11. Bottle height: it is important to keep the bottle at an optimum height, neither too high nor too low.
   a. Very high bottle height can in turn force fluid through weak areas of the zonules hydrating the vitreous resulting in positive pressure, anterior chamber shallowing and vitreous prolapse.
   b. Too low bottle height can result in an outflow, which is greater than inflow again resulting in shallowing of anterior chamber, a negative pressure in AC and further vitreous prolapse as the anterior segment is less pressurised than the posterior segment.

12. Divide and or chop technique are preferred in eyes with zonular weakness. This technique minimises zonular stress during phacoemulsification if surgeon is careful to apply equal forces in opposing directions to avoid displacing the nucleus.

13. “Visco dissect” nuclear halves / quadrants in areas of zonular weakness. The viscoelastic should be injected below the nuclear fragment and the capsular bag- lifting the nuclear fragment as well as expanding and stabilizing the capsular bag. Additional cortical removal by visco dissection will limit stress on the remaining zonules during aspiration of cortex.

14. Automated Irrigation and Aspiration device is not preferred for cortex removal as it can hydrate vitreous and increase vitreous prolapse. Manually aspirate with a 24/27 G cannula striping cortex in a tangential manner instead of radially to limit stress on zonules. A ‘J’ cannula can be used for sub incisional cortex. Ensure removal of all vitreous from the anterior chamber if it is present. Use ‘Dry vitrectomy’ with automated vitrector after filling anterior chamber with viscoelastics. For significant vitreous loss a bimanual vitrectomy should be performed.

Stabilization of the Capsular Bag

In cases of moderate zonular loss or dysfunction in the 3-to-6 clock hour range, some form of augmented capsule support will likely be needed. Flexible iris retractors placed through limbal stab incisions can be used to hook the capsulorhexis edge and support the bag. Capsule hooks support the bag by its equator, not the capsule margin, thereby keeping the bag distended and also reducing the likelihood of aspiration of the bag equator as the lens material is evacuated. A further option to stabilize the bag during phacoemulsification would be placement of an Ahmed segment. Some surgeons may prefer to place a CTR early in the procedure.

Capsular Tension Ring Selection

Deciding which CTR to use depends on the degree of and likelihood for progression of damage. When the dialysis is small, a standard CTR is usually adequate. If there is more than 4 clock hours of damage or if the lens is moderately to severely displaced, a fixation device is required either Cionni Ring or Ahmed capsule tension segment.

Suture Material

Suture material should be permanent. Polypropylene 10-0 is unadvisable, as it will hydrolyse over time with a roughly 5- to 10-year survival time. Polypropylene 9-0 should have a longer survival time. A polytetrafluoroethylene CV-8 suture has been used for scleral fixation off label and to date has had excellent longevity.

IOL placement options

1. The surgeon should decide if it is safe to use an ACIOL or PCIOL.
2. If an ACIOL is used the remnants of the capsular bag should be removed to prevent contraction and opacification.
3. If the surgeon uses a PCIOL it should be either
a. Sutured to the scleral wall or
b. Placed in the capsular bag
Ciliary sulcus placement of PCIOL without suture fixation in an eye with significant zonular compromise is not recommended.

Placement of PCIOL into the capsular bag
1. Placement of PCIOL into the capsular bag is challenging when there is significant zonular weakness as one must achieve IOL centration, and maximize long term stability.
2. Use of 6 mm optic diameter IOL decreases the chances of undesirable edge - glare symptoms should lens decentration occur post operatively. Haptic configuration designed for broad contact with equatorial capsular bag increases the chances of long term centration. Use of silicone plate haptic IOL should be avoided in the presence of zonular dialysis as there is greater chance of capsular contraction and decentration.
3. Insertion of CTR to provide 360 deg. capsular bag expansion and greater stabilization.
4. If the ZD is located at the incision site, lens placement is more difficult.
   One Option is to first place the entire lens into the AC. Then using a two handed technique, the superior haptic is inserted into the capsular bag followed by a similar manoeuvre for the inferior haptic.
5. Orientation of the IOL: There are 2 schools of thought.
   a. Orienting the IOL in a plane parallel to the zonular dialysis (ZD) in order to take advantage of the remaining intact zonules. This orientation will provide optimum support but may induce ovaling of the capsular bag and an increased risk of postoperative decentration.
   b. Placing one haptic in area of ZD will ensure stretching of the bag and decrease ovaling. However it should be borne in mind that only one haptic is adequately supported.
It is recommended to orient the haptics in whichever axis that provides the best centration intra operatively. This is accomplished by careful rotation of PCIOL.
In large subluxations, where it is not possible to perform a capsulorrhexis, the nucleus is removed with its bag and a trans scleral fixation of a posterior chamber intraocular lens is performed.

In conclusion, advanced phacoemulsification technology, good OVD, CTR and MCTR have made it possible to save and recenter the capsular bag, and perform in the bag PCIOL implantation in cases of subluxated cataracts revolutionizing the approach to subluxated cataracts. However, in cases of generalized zonular weakness and dehicense 270 degrees or more, intracapsular cataract extraction followed by scleral fixation of PCIOL/anterior chamber IOL implantation is a safer option for the long term stability of the IOL.

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