COVER FOCUS

Editorial review- Surgical correction of aphakia

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Introduction: Intra ocular lens implantation is an accepted standard of care in patients with aphakic state and should ideally, be placed in the capsular bag, as it provides not only a position closest to the nodal point of the eye but also a stable fixation. However, in some instances this may not be possible. Lack of lens capsule or weaknesses of the zonules due to trauma or a complicated cataract surgery are the main reasons where 'in the bag implantation' of Intra ocular lens (IOL) may not be possible. Various methods that allow intraocular lens implantation in the absence of capsular or zonular support include anterior chamber angle and iris-fixated IOLs, as well as posterior chamber scleral and iris-sutured lenses, more recently the glued IOL.

Various methods of rehabilitation in an aphakic patient lacking capsular support may start with simple aphakic glass and contact lens. However, the limitations of these are well known. IOL implantation obviates the need for the above. Choice of IOL in these patients include anterior chamber intraocular lens, posterior chamber lens include iris sutured lens, posterior chamber IOLs, scleral fixated IOL and posterior iris clip lens. Each of these lenses has their own advantages and disadvantages.

ANTERIOR CHAMBER INTRAOCULAR LENSES include angle supported and anterior iris clip lens. Angle-supported lenses are the most commonly used ACIOLs. They have the flexible open loop designs, which have a lower rate of complications than the earlier closed loop or open 'C' loop lenses.[1]. ACIOLs also have an anterior vault that minimizes the risk of IOL-iris touch and iris chafe. Anterior chamber iris-fixated lens include iris clip lenses and irido-capsular lenses. Iris clip lenses are fixed at the pupillary border usually via four clips, while adhesions between the anterior lens capsule and the iris hold the haptics in iridocapsular lenses.[2] Iris clip lens design commonly used now is a modification of the iris claw lens designed by Worst in 1978 .[3] They are placed anterior to the iris and secured by clipping small sections of mid peripheral iris through the claws.[2]

Alternatively, they have also been fixated to the posterior iris surface where the anterior chamber is very shallow or in the presence of extensive peripheral synechiae.[4]

As the technique of insertion of angle-supported anterior lenses is relatively simple it is the most commonly used method in patients lacking capsular support, however ACIOLs have some vision threatening complications as described below.

Potential complications of anterior chamber IOLs.

a) Corneal Decompensation

A limited degree of endothelial cell loss commonly occurs with each intraocular procedure however most do not progress to corneal decompensation. Pseudophakic bullous keratopathy is usually seen with ACIOLs of incorrect size, steep anterior vault and in IOLs with inappropriate degree of flexibility. Solomon et al have reported a complication rate varying from 13% to 25% for closed-loop ACIOLs [5] while Kelman Multiflex had 5-6% rate of complications. ***Endothelial cell loss can occur even after perfectly implanted ACIOLs due to subclinical uveitis caused by lens tissue contact that liberates products of inflammation, that are directly toxic to the endothelium.***[6] Corneal edema is one of the most common cause of a poor visual recovery in patients undergoing secondary ACIOL implantation [7] hence these implants should be avoided in patients with preexisting corneal endothelial problems. Problems are much less likely with

newer ACIOL models having flexible loops and a highly polished surface

b) Glaucoma

The placement of ACIOL increases the risk of glaucoma as the haptics may cause trabecular meshwork damage, angle fibrosis and even Peripheral Anterior Synechiea formation. In a retrospective study in patients undergoing penetrating keratoplasty by Brunette et al that included both open-loop as well as a flexible closed loop type AC IOLs a mean increase in IOP of 2.5 mm was found.[8] However, Schein et al found the incidence was least with flexible, open-loop four-point fixation ACIOLs when compared with either iris or scleral sutured lenses during 18 months of follow-up.[9] Secondary glaucoma due to chronic uveitis may result if there is persistent vitreous traction or chafing against uveal tissues. When using ACIOLs, size, vault, flexibility and smoothness of surface are critical because of close proximity to angle, cornea and uveal tissue. Oversized lenses or incorrect IOL insertion could result in iris tuck with secondary pupil ovalisation.[6]

This results in excessive IOL contact with uveal tissue, causing pain and chronic uveitis, also a high incidence of the uveitis glaucoma hyphema(UGH) syndrome may be found with uniplanar ACIOLs particularly those with rough or poorly finished surfaces, However, with newer designs incorporating tumble polishing to give rounded smooth lens surfaces the incidence of chafing and UGH has fallen markedly. Erosion of the haptic into the ciliary body or angle recess may occur if the ACIOL is oversized.[6]

c) Cystoid Macular Edema

Cystoid macular edema (CME) is usually associated with complicated cataract extractions. The incidence of CME following flexible openloop ACIOL implantation has been reported to range from 1.2% to 10%.[10], [11] Various factors influence the frequency with which CME occurs with ACIOL implantation, of which posterior capsule rupture and vitreous loss during original surgery is an important factor.[12] In their series of 143 cases, David et al found CME to occur exclusively in eyes where ECCE was complicated by posterior capsule rupture and anterior vitrectomy when comparing ACIOLs inserted as secondary implants after ECCE complicated by vitrectomy, or after primary ICCE.

POSTERIOR CHAMBER INTRA OCULAR LENSES

Advantages of PCIOLs are well known , they produce minimal aniseikonia as they have a position close to the nodal point of the eye.[13],[14] Placing the IOL in the posterior chamber ensures a position furthest from the corneal endothelium.

Iris-sutured PCIOL can be secured to the iris with 10-0 polypropylene suture using the technique described by McCannel in 1976 originally used for iris suturing.[15] Chang has described the use of Siepser's sliding knot technique to suture the haptics to the iris[16] which avoids excessive traction on the iris but a larger wound is required for use of Vannas / microincision scissors.

Transsclerally sutured PCIOL fixation is a commonly used method and was described by Malbran et al in 1986. [17] PCIOLs are usually sutured to the sulcus and can also be sutured at the pars plana however the latter method is not popular.[18], [19] These IOLs have several specialized haptic designs, like eyelets to allow of suture fixation or an enlarged end to avoid suture slippage.

Implanting these IOLs is technically more demanding than inserting an ACIOL. Although they are cornea protective they still are associated with some serious complications.

Complications common to posterior chamber lenses

a) Cystoid Macular Edema

In some series[9,20] Cystoid Macular Edema was noted to be the most common complication and its reported incidence after secondary scleral sutured PCIOLs, ranged from 5.5% [20] to 6.1%. [21] most important factor contributing to this complication is vitreous loss or rupture of the anterior hyaloid.

b) Endophthalmitis

Endophthalmitis, a dreaded complication may either occur acutely or may have delayed presentation caused by organisms of low virulence that may present months to years after the procedure. Endophthalmitis can be caused due to pathogens that are introduced at the time of surgery or that gain access to the eye via exposed

sutures in cases of suture-fixated PCIOLs. ***Suture related enophthalmitis is a major drawback of scleral sutured lens as the erosion of suture knots through the conjunctiva creates a direct communication between the intra- and extraocular environments.*** Hence it is important to avoid having exposed suture ends as they can erode through partial-thickness scleral flaps and conjunctiva with time. Burying knots into the sclera or tying the knot in the depths of a partial-thickness scleral incision may help prevent this complicationInitially, up to 24% of cases experienced this problem when sutures were tied under conjunctiva alone. With use of scleral flaps this problem can still occur in 15% of cases.[22] This higher rate of infection even with scleral flap could be due to scleral flap atrophy with time.

c) Hyphema/Vitreous Hemorrhage

As suturing PCIOLs require needle passes through uveal tissue, risk of bleeding exists. Intraocular bleeding is usually related to direct uveal trauma during needle passes but can also occur due to wicking of extraocular blood into the eye along the suture.[23] Attention to hemostasis during conjunctival and Tenon's capsule dissection of will help to avoid the occurrence of this complication. In most instances, bleeding is minor and resolves spontaneously. significant bleeding may lead to ghost cell glaucoma.[24]

d) Lens tilt/decentration

Decentration and potential tilt around the points the lens is sutured can occur especially when there is lack of lens capsule support. Tilt / decentration results in oblique astigmatism and myopic shift.[25,26,27] Using 2-point scleral fixation of the PCIOLs significant lens tilt greater than 10 degrees was reported in 11.4--16.7% of patients.[28,29] Suture loosening/rupture can result in partial IOL dislocation into the vitreous. IOL dislocation can occur due to polypropylene disintegration, disruption of knot integrity or if there is internal cheese wiring of the suture. Although haptics become encased in fibrous tissue and lens stability becomes independent of suture integrity, however, it cannot be relied upon as reported in the study by Lubniewski [30]. If the suture becomes exposed additional procedures like trimming or cautery of the knot and surgical coverage with a corneal or scleral patch graft may be required. Burying the knot as described by Lewis [31] will significantly reduce the incidence of these complications, although this technique is slightly more complex.

e) Retinal Detachment

Incidence of retinal detachment after cataract surgery is more common when the anterior hyaloid face has been disturbed. Post-surgery retinal detachment rate of 4.9% was noted in a series of 122 eyes with follow-up of up to 42 months,.[32] Although some eyes undergoing scleral fixation would have suffered trauma and the detachment rate may not directly be related to the surgery itself. However ***in most cases, location of the retinal tear corresponded to the IOL axis near the fixation sutures suggesting trauma to the vitreous base by the needle or lens haptics Meticulous removal of vitreous prior to IOL implantation may reduce these complications.***[32]

f) Suprachoroidal Hemorrhage

It is a rare complication considering the uveal manipulation that occurs during scleral fixation of a PCIOL. Iridodialysis and intraoperative hemorrhage can occur during suturing iris fixated lens. Risk of hemorrhage can be reduced by minimizing iris manipulation and by paying close attention to needle placement during suturing.

g) Chronic inflammation

Iris-sutured lenses have increased risk of chronic inflammation because of the mobility of iris tissue as sutures are placed within iris tissue and also with an IOL close to its surface. However, the chronic inflammation has not consistently been shown to be clinically significant and also when compared with ACIOLs or scleral-fixated lenses iris sutured lenses were not associated with increased incidence of CME or corneal edema.[33, 9] Factors that affect the likelihood of suture related iris chafe are the location of suture placement and tightness of the sutures. As the central iris is most mobile, a suture placement here would not only result in excessive inflammation, but also result in an irregular pupil with peaking at those sites. Tight sutures or large bites of iris may also cause peaking of the pupil or bunching of the iris.

IOL implantation in the absence of capsular support, have been satisfactory in general, with respect to visual results and complication rates. Several authors have conducted studies to compare results for the different ways of lens implantation. Lass et al compared 24 patients who had suture-fixated PCIOLs with 25 who had Kelman style ACIOLs following penetrating keratoplasty (PKP).[33] A progressive decrease in endothelial cell density, especially between 6 and 12 months postoperatively was seen in both the groups and they did not find any significant difference between the groups with respect to endothelial cell loss at 1 year. Suture fixated PCIOLs did not fare better over Kelman-style ACIOLs in terms of best corrected visual acuity, intraocular pressure control and CME. In another study iris-fixated PCIOLs were compared with Kelman-style ACIOLs that were implanted during keratoplasty. They reported that ACIOL had a lower endothelial cell loss at 1year(11.2%) compared to the PCIOL (19%).[34] However, endothelial graft rejection within 24 months was more common in patients with ACIOL (12.5%) compared with iris sutured PCIOL cases (3.8%). A randomized study by Schein et al [9] compared ACIOL, iris-fixated PCIOL and transsclerally fixated PCIOL during penetrating keratoplasty for pseudophakic corneal oedema. In their study of 176 consecutive patients, complication rate based on major outcomes of glaucoma escalation, CME, IOL dislocation, and graft failure was studied.They found ***a higher complication rate for scleral-fixated IOL compared to iris-fixated IOLs while ACIOLs carried an intermediate risk. They also reported a lower rate of CME (which was seen as early as 6 months postoperatively) for iris-fixated PCIOLs compared with ACIOLs or transsclerally sutured PCIOLs.*** They also had no cases of dislocation among the iris-fixated lenses while three scleral-fixated IOLs required refixation due to subluxation or tilt. There were no significant differences in the risk of graft failure or of glaucoma treatment escalation.

Lyle and Jin in their retrospective study of 348 cases of secondary IOLs, comparing 234 eyes with ACIOLs with 114 eyes receiving PCIOLs have found increased risk of retinal detachment for scleral fixated IOL (3.5%) compared to 0.9% with ACIOLs .[35] In another series by Belluci et al, [36] reported that retinal detachments were also more frequent for scleral fixated PCIOLs(6%) compared with ACIOLs(3%).

Sclera fixated IOLs also had significantly greater chance of tilt and decentration than in the other two methods. In a study by Uozato et al ***IOL tilt greater than the 5 degree was stated to cause significant refractive error***[37]. Hayashi et al [29] reported a mean tilt angle of 6.35 and an 11.4% incidence of severe tilting greater than 10 degree, hence sclera fixated IOLs have a risk of causing in significant post operative refractive error.

One year results of Glued IOL [38] are encouraging, they reported early post-operative complication of decentration was seen in 5.6% while late complications reported were pigment dispersion (3.7%) and healed macular oedema (7.5%). No vision threatening complications such as retinal break, retinal detachment, or endophthalmitis were reported. The percentage (%) loss of endothelial cells was 5.23+/-3.4% at 1-year follow-up. No pseudo-phakodonesis was seen in the follow-up visits.

Conclusion:

Although many methods have been described in visual rehabilitation of the aphakic eye lacking capsular support each of these are different with regards to technical difficulty and potential postoperative complications. Used appropriately, any one of the methods can result in a good visual outcome provided clinician takes into account the different variables and utilizes the method which is best suited for the patient with the least potential complications.

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