Late Spontaneous in-the-bag intraocular Lens Dislocation

Continuous curvilinear capsulorhexis, phacoemulsification and in-the-bag placement of the intraocular lens (IOL) represents the standard of care for cataract surgery. Capsulorhexis has been hugely successful in phacoemulsification, allowing a safe site for IOL implantation. However, the technique is not without complications, with capsular shrinkage and dislocation of the capsular bag-IOL complex being the most important in the short and long term, respectively.¹

Late spontaneous in-the-bag IOL dislocation is a potential complication of cataract surgery in which an IOL that is properly placed within the capsular bag (with or without a capsular tension ring) decenters many years after uneventful surgery.² The three aforementioned requirements—late, spontaneous and in-the-bag fixation of the IOL—must be fulfilled to establish the diagnosis. Unlike in-the-bag dislocation, out-of-the-bag dislocation typically occurs early after surgery, and is caused by rupture of the equatorial capsule or tearing of the posterior capsule.³ Additionally, cases of in-the-bag IOL dislocation resulting from an external trauma, whether accidental or iatrogenic (history of vitrectomy or intraoperative zonular dialysis) should not be categorized as late and/or spontaneous. Some authors arbitrarily choose a cut-off of three months as the limit between early and late in-the-bag IOL dislocation,⁴,⁵ very different from the mean interval found in typical cases of late in-the-bag dislocation, which has been estimated at 7.5 years.²,³,⁶-¹¹ Early in-the-bag dislocation is more likely to be the result of zonular damage during surgery. These various conditions differ from in-the-bag IOL dislocation in the interval between the original surgery and dislocation, predisposing factors, and management.²,³ Reports in the literature are scarce, and only a few include a relatively high number of patients.²-¹¹ In addition, there is considerable confusion in current literature on this topic, and all the above-mentioned entities are usually dealt with as a whole, without providing separate data on some of the outcome measures.³,⁸,¹⁰

The exact incidence of this complication is difficult to estimate, given the long time frame for presentation, and varies widely. A Swedish population-based study recently estimated late in-the-bag chamber IOL dislocation requiring surgical intervention to have an annual incidence of 0.05% in western Sweden¹⁰ and a 10-year cumulative incidence of 1% in northern Sweden (one third of cases were out-of-the-bag),⁴ while a similar approach in Minnesota yielded a 10-year cumulative risk of 0.1%, including 44% out-of-the-bag cases and extracapsular cataract extraction cases.⁵ This 10-fold lower IOL dislocation estimate in southern Minnesota compared with Sweden at 10 years after surgery may in part be the result of a higher prevalence of pseudoexfoliation in the Swedish cohorts, the main risk factor for in-the-bag IOL dislocation. Several authors have found an increase in recent years in the number of patients requiring surgery for late in-the-bag IOL dislocation at their centers, raising concerns of an epidemic of IOL dislocations.²,⁷,⁹ It is not clear whether this is because the pseudophakic community is growing and/or whether the type of cataract surgery technique also plays a role. However, the above-mentioned population studies were unable to demonstrate a significantly increased incidence rate.⁵-¹⁰ In fact, our own recent data show that the number of surgeries increased yearly from 2004 to 2007 but has remained stable since 2007 to 2012 (Lorente R, unpublished data 2012). In any case, although its actual incidence seems to be low, the potential burden to society of this condition could be considerable, as longer
life spans mean that the number of people undergoing cataract surgery is increasing. In Spain, a recent study has identified IOL dislocation as the main cause of IOL explantation, accounting for 56% of cases, 40% of these being in-the-bag subluxations.\textsuperscript{12}

The mechanisms that lead to IOL dislocation are two-fold: progressive zonular weakness and capsule contraction syndrome, with the exact contribution of each mechanism varying on a case-by-case basis.\textsuperscript{7} Zonular weakness with or without capsule shrinkage leads to an imbalance between centrifugal and centripetal forces over the capsular bag, resulting in dislocation. Entities that have been associated with progressive zonular dehiscence are pseudoexfoliation, by far the main risk factor, connective tissue disorders and high myopia.\textsuperscript{2,3,6-11} When it comes to the role of capsule contraction syndrome, we must bear in mind that late in-the-bag dislocation was virtually unreported before the popularization of capsulorhexis. The centripetal forces on the zonule caused by the fibrosis around an intact capsulorhexis are more pronounced than on the irregular edge of a can-opener capsulotomy, and recent studies have found that dislocation occurs earlier in cases with capsular fimosis.\textsuperscript{11} Some degree of capsule contraction is common in most eyes, but profound capsule shrinkage has been described in pseudoexfoliation, diabetes mellitus, uveitis, pigmentary retinal degeneration and myotonic dystrophy.\textsuperscript{7}

The main risk factor identified consistently in all series is pseudoexfoliation (66.6% of cases),\textsuperscript{2,3,6-11} which is the only factor which has a role confirmed in a case–control study.\textsuperscript{5} Additional case control studies would be desirable to assess and weigh the importance of the other predisposing conditions mentioned. This information would be of utmost importance to identify patients at risk and to design preventive strategies.

Taking into account the two mechanisms involved in the dislocation, preventive strategies can be divided into three categories.\textsuperscript{1} The first, with full consensus among surgeons, includes those measures that minimize zonular damage during cataract surgery in at-risk cases, since we cannot stop progressive zonular dehiscence. The second and more controversial strategy is whether to modify the IOL implantation site/technique. In-the-bag placement with some form of scleral IOL fixation (scleral suture of a capsular tension ring (CTR), Cionni ring, Ahmed segment, etc.) can be accomplished in cases of severe zonular instability during surgery. An alternative technique would be to implant the IOL in the sulcus, performing an anterior optic capture. Although there is no agreement in the literature over the best option, it is our opinion that it is preferable for the IOL to be implanted within the capsular bag and fixated rather than implanted in the sulcus, a technique that is associated with more inflammation and risk of pigment dispersion if optic capture is not accomplished.\textsuperscript{1}

The role of the CTR in prevention is a matter of debate.\textsuperscript{2,10,11} Some authors have hypothesized that the ring could prevent dislocation and capsular shrinkage. However, cases of in-the-bag dislocation with a CTR within the bag have been published.\textsuperscript{2,10,11} In our previous series of 45 cases, 8 of them had a CTR\textsuperscript{2} and in our current data (Lorente R, unpublished data 2012), 22 out of 106 cases of dislocation occurred despite having a CTR within the bag. Moreover, it has been found that the interval between the original cataract surgery and IOL dislocation is shorter in cases with CTR.\textsuperscript{2,11} This could be the result of selection bias, with CTR being implanted in the worst cases, or increased zonular damage due to additional stress on the zonules during implantation of the CTR. Thus, ubiquitous prophylactic use of CTRs does not seem to be a suitable approach in patients with pseudoexfoliation and no phakodonesis undergoing cataract surgery. However, it is our opinion that CTRs are advisable in cases of zonular insufficiency and in advanced pseudoexfoliation syndrome. They clearly facilitate repositioning, particularly in cases of plate-haptic lenses without holes. It is currently unknown whether the cost of implanting a CTR in all at-risk eyes is justified by the potential decrease in the incidence of dislocations.
Lastly, the third preventive strategy would be careful observation of the capsulorhexis after surgery. We recommend anterior relaxing capsulotomy as a preventive measure to halt progressive capsular shrinkage in susceptible eyes, and it should be performed as soon as early contraction is detected, usually in the first month after surgery.

Thus, we believe that in mild cases of pseudoexfoliation with no phacodonesis, the IOL may be implanted in the bag, with close monitoring of capsular contraction; in moderate cases a CTR should also be implanted; in severe cases with intraoperative evidence of zonular instability, in-the-bag placement with some form of scleral IOL/CTR fixation (scleral suture of a CTR, Cionni ring, Ahmed segment, etc.) is strongly recommended.

Management of in-the-bag IOL dislocation requires special considerations. Surgical options differ and may vary from IOL repositioning to IOL exchange, but the surgical indications and optimal timing for management have not been definitively established. A variety of therapeutic options are available, including repositioning or replacement. Data on management strategies in series with more than 20 cases of in-the-bag IOL dislocation are limited to four retrospective series. Prospective studies on the outcomes of different management techniques would be desirable.

Observation is an alternative only in cases presenting pseudophakodonesis without inferior dislocation, which are mainly asymptomatic. A surgical approach is recommended whenever any dislocation, no matter how small, is detected. Once surgical management is decided, the approach depends on the surgeon’s preferences and specialty and the clinical features of the individual case, including type of IOL and presence of CTR, stage and site of IOL dislocation, and coexisting ocular pathology. Surgical approaches include repositioning and replacement. Repositioning using *ab externo* scleral fixation is our preferred approach. The advantage of repositioning and suturing the IOL is that it does not require a large limbal incision, thus reducing trauma to the corneal endothelium and postsurgical astigmatism. On the basis of our experience, repositioning can be accomplished in grade I and II dislocation, with open-loop lenses and plate-haptic lenses with holes or associated CTRs, and in cases with no excessive residual cortical material or advanced capsular shrinkage. Repositioning could also be considered in grade III dislocation, although in these cases surgical maneuvers are more difficult.

The IOL must be replaced in cases with grade III dislocation, damaged IOL or haptics, capsular phimosis and presence of excessive residual cortical material. Another indication for replacement is in plate-haptic IOLs with no accompanying CTR or holes. Whether to use an anterior chamber lens or sutured posterior chamber lens during replacement remains controversial. A review of the literature and an evidence-based review concluded that there is insufficient evidence to support the superiority of scleral or iris-supported posterior chamber lenses over open-loop anterior chamber lenses. There is no consensus on the indications, relative safety or efficacy of these alternatives. Hayashi et al. found that, after replacement with a scleral-sutured lens, corrected distance visual acuity (CDVA) did not improve markedly, and the incidence of postoperative complications was high. We did not find any statistically significant difference in postoperative CDVA between the eyes that underwent repositioning using scleral fixation and those in which the lens was replaced by an angle supported anterior chamber IOL or an iris-claw IOL.

Ophthalmologists will have to deal with late in-the-bag IOL dislocation much more frequently in the years to come. The analysis of a large series of in-the-bag IOL dislocation with three proper uniform inclusion criteria (in-the-bag, late and spontaneous) could provide more reliable data on several clinically relevant parameters, particularly on risk factors and outcomes of the different management approaches, issues of paramount importance when defining preventive and treatment strategies.
REFERENCES


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