A patient with dropped nucleus and intraocular lens

Comments by:
Ricky W. K. Law, FRCS, FCOphthHK, Ronald Yeoh, M Med (Singapore), FRCS, Tarun Sharma, MD FRCS (Ed)

Case history

A 75-year-old female underwent surgery for left cataract. She complained of blurring of vision for several months. Her preoperative visual acuity was hand movement in the operated eye and 0.3 in the other eye. The lens opacity consisted mainly of a dense whitish posterior subcapsular plaque covering the axial region. The other eye had similar lens opacity. Her past health was unremarkable except for a history of hypertension.

Phacoemulsification was performed using a clear corneal temporal approach. A 5 mm capsulorhexis was made using a viscoelastic substance followed by hydrodissection in the usual manner. However, shortly after hydrodissection, the whole lens nucleus disappeared into the posterior vitreous. A vitreo-retinal surgeon was called into the operating theatre. A 3-port vitrectomy was performed and a large whitish nucleus was seen in the posterior vitreous. Perfluorocarbon liquid was injected to float up the nucleus that was then manipulated into the anterior chamber and removed via the limbus with the assistance of a vectis. The heavy oil was removed and the capsulorhexis remained intact. A one-piece heparin surface-coated polymethyl methacrylate lens of 13.5 mm haptic and 6.5 mm optic diameter was inserted into the sulcus.

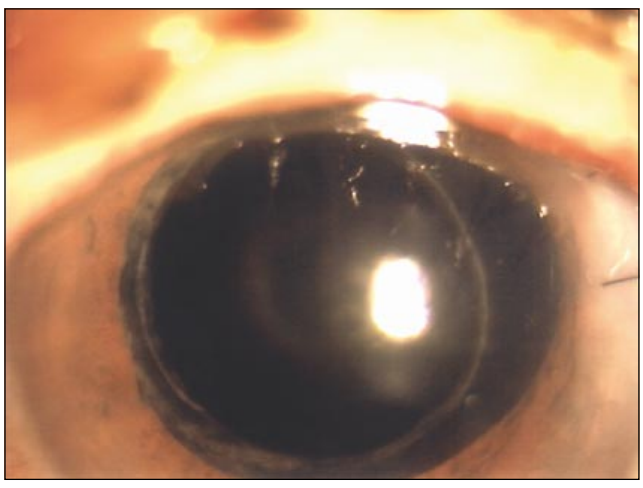

Figure 1. The operated eye showing the intact capsulorhexis rim.

On the first postoperative day, no complications were noted and the intraocular lens was stable. However, on the second day, the intraocular lens was found to be dislocated into the posterior vitreous while the capsulorhexis remained intact (**Figure 1**).

What could be done to prevent this complication? How would you approach the management of this patient?

Comments

by Dr Ricky W. K. Law, Associate Professor, Department of Ophthalmology & Visual Sciences, The Chinese University of Hong Kong, Hong Kong, China.

Performing phacoemulsification in patients with dense posterior polar cataract is known to be associated with a high complication rate, with spontaneous posterior capsular rupture with or without dropping the nucleus being one of the most worrying complications. The dense posterior plaque more strongly adheres to the posterior capsule and the high intracapsular pressure that the normal capsule can withstand during hydrodissection is no longer possible in eyes with polar cataract due to the weak points in the adherent capsule-posterior capsular plaque-complex. Instead of the usual capsular-cortical cleavage, vigorous, brief, and strong hydrodissection will result in rupture of the posterior capsule and dropped nucleus. Another reason for easy posterior capsular rupture is the difference in hardness of the posterior polar plaque compared with the other parts of the cataract. Continuous pushing of the phaco tip during sculpting without increasing the phacoemulsification energy, slowing the advancing tip, or shallower sculpting will exert considerable stress on the capsule and zonules. Direct trauma to the posterior capsule during phacoemulsification, and any other manipulation may easily rupture the posterior capsule.

In order to prevent complications from occurring, it may be beneficial to use a less vigorous hydrodissection maneuver. More emphasis on hydrodelineation may help to protect the posterior capsule with a thicker epicortical cushion and at the same time allow intracapsular manipulation. Debulking the cataract and subsequent visco-dissection of the

remaining posterior capsular plaque and cortex may also help to lower the risk of serious complications.

The reason for the luxated intraocular lens (IOL) for this patient is obscured. Close examination may sometimes reveal small tears in the curvilinear anterior capsular edge especially after major manipulation. Masked zonular damage may be the other reason for the luxated IOL. It has been demonstrated in a large postmortem study that more than 50% of (51.52%) polymethyl methacrylate is not in the bag-bag placement fashion.[1] The modern small incision surgery with curvilinear anterior capsular opening and foldable IOL implantation is believed to be more reliable in keeping the IOL haptics in the bag, but the same study demonstrated that only 90% of the IOL were in the bag-bag position.[1] Loya et al reported on an ultrasound biomicroscopy evaluation of posterior chamber IOL implantation after capsular tear. Optic tilt was found in 56% of patients, while 47% of patients were found to have sulcus-sulcus haptics placement, 42% had sulcus-bag/elsewhere placement, and 2.7% required another surgery for a dislocated IOL.[2] Optic capture was not unusual in this situation and subsequent haptics capture and dislocation may follow. Postoperative inflammatory response and heavy liquid may render the remaining anterior capsule soft and distended. Post-operative hypotony and ciliary body edema may loosen the zonular tension and result in the inversion of the anterior capsular rim and result in enlargement of the continuous curvilinear capsulorhexis (CCC) capsular opening. The CCC may simply be larger than 5 mm in diameter as the optical effects and the differences in refractive index of the cornea and aqueous may make a large CCC opening look smaller.[3]

Preventive measures to avoid subsequent dislocation of the IOL involve making a smaller CCC. Four to 4.5 mm diameter CCC will give good stability. An initial small CCC with subsequent secondary spiral enlargement may be useful for preventing the accidental creation of too large a capsular opening at the start. The larger optics of scleral-fixated IOLs may be useful in some cases and the eyelets may be useful for the scleral fixation of the IOL if subsequently dislocated without opening the wound and extraction of the IOL. One-point or 2-point scleral fixation of the IOL or the implantation of an anterior chamber IOL can be more secure if in doubt. The control of postoperative hypotony and inflammation are mandatory.

If aphakia is found during the slit lamp examination on postoperative day 2, biocular indirect ophthalmoscopic examination should be performed, with the patient in the supine position. A luxated IOL should be in the most dependent position of the globe, especially in vitrectomized eyes where vitreous support is minimal.

The patient should be advised to rest, preferably in bed. The prone position is the most desirable position. Post-operative steroids and antibiotics should be continued and homatropine or atropine eyedrops should be given to diminish post-operative pain and ciliary spasm and to dilate the pupil.

Conservative treatment of adopting the prone position with mydriatics may be an option, although this is not always effective. Regular surveillance should be performed. If the IOL is found to be displaced into the anterior chamber, pilocarpine should be given as soon as possible to capture the IOL within the anterior chamber.

It is more usual to proceed to surgical management for the luxated IOL. This involves 3 folds: firstly to hold the IOL in the vitreal cavity to avoid retinal damage; secondly to capture the IOL in the anterior chamber; and lastly, to secure the IOL to ensure early visual rehabilitation.

Floating the IOL with perfluorocarbon is commonly performed, although some authors felt that it was costly.[4,5] Using the pars plana approach with the use of micro-instruments, one can effectively grasp the IOL, but extreme care must be exercised to avoid unnecessary manipulation of the IOL or an instrument hitting the retina. A method using an intraocular cow hitch to hook the haptic has been described by Hanemoto et al.[6] This technique is innovative but is technically demanding.

It is controversial whether to add topical miotic agents intraoperatively once the luxated IOL is brought above the iris diaphragm. It is safer to add these agents if the pupil is constricted but it may make subsequent surgical manipulation and scleral placement of the IOL difficult. A dilated pupil may render the IOL susceptible to dislocation. One way to solve the problem is to use iris hooks or temporary sutures for a dilated pupil or to remove the luxated IOL with an extended wound and to implant an anterior chamber IOL in front of the constricted pupil.

Secure stabilization of the IOL to ensure early visual rehabilitation and to prevent future dislocation is a major concern in the management for this patient. Various techniques have been described for a luxated IOL. IOL extraction has been adovated,[7,8] but the removal and reimplantation of the IOL may cause considerable corneal endothelial loss, and the creation of a larger scleral or corneal incision (by extending the existing temporal corneal wound) to extract the IOL may produce visually disturbing postoperative astigmatism. Other ways of suturing a luxated IOL without lens extraction have their own advantages and drawbacks: the hooking haptic technique[9-12] is relatively simple but the IOL may not be securely fixated because of the single knot; the use of perfluorocarbon is costly[4,5] and requires a 360° intact lens capsule, but is highly likely to fail in this patient as the IOL is basically dislocated from a 360° intact lens capsule; externalizing the haptic through the pars plana sclerotomies[11,13-14] may damage the ciliary body and retina and the fistula will pose a considerable risk of infection; the lens lasso technique utilizing a slipknot to the lens haptic passing through the sulcus may damage the ciliary body and pull out residual vitreous. The technique advocated by Hanemoto et al[6] using the intraocular cow hitch knot posed the least risk of these complications but this technique uses a specially designed single-needle looped 10-0 polypropylene suture that is not commonly available in Hong Kong.

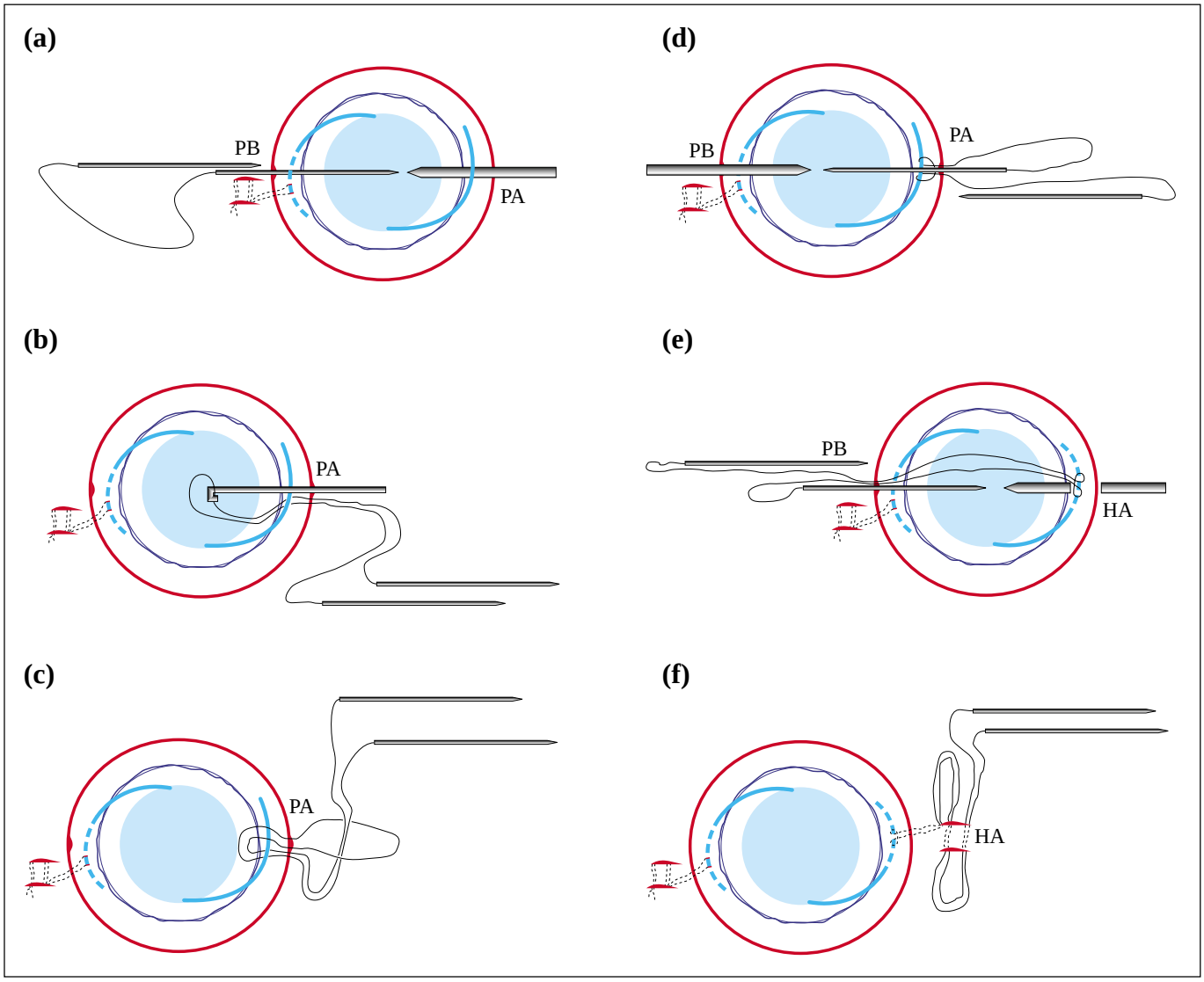

Figure 2. The modified cow hitch knot technique using a 10/0 prolene double straight needle. (a, b, c) The paracentesis needs to be entered twice by each straight needle for each cow hitch knot to be made for each haptic; (d) the knot can be reintroduced into the anterior chamber through paracentesis A (PA); (e) the knot can be reintroduced into the anterior chamber through paracentesis B (PB) and exit through Horiguchi's incision A (HA); (f) the sutures can be tied in the fashion of a mattress suture.

Using the operating microscope, viscoelastic could be injected behind the optics to support the IOL, but a vitrectomized eye requires the injection of a large amount of viscoelastic, which may be undesirable or ineffective. However, using viscoelastic to protect the endothelium and to create a space in the anterior chamber to work with is mandatory, but it should not be so much as to push the IOL backward into the vitreous cavity. Depending on the intraoperative assessment of the anterior capsule, the simplest hooking haptic technique may be used to secure one (superior haptic) or both haptics,[9-12] although it may be advisable to have a more secure placement of the scleral fixated IOL since this is a complicated case with multiple surgeries. The cow hitch knot technique[6] could be modified by using a 10/0 prolene double straight needle (which is commonly available in Hong Kong) instead of Hanemoto's specially designed single-needle looped 10-0 polypropylene suture (**Figure 2**). The difference lies in the fact that the paracentesis needs to be entered twice by each straight needle for each cow hitch knot to be made for each haptic (**Figures 2a** to **c**). The knot can simply be reintroduced into the anterior chamber through the paracentesis A (**Figure 2d**), come out through paracentesis B (guided by a bent 27 gauge needle), and be reintroduced into the anterior chamber through paracentesis B (**Figure 2e**), and exit through Horiguchi's incision A at the ciliary sulcus 1.5 mm from the limbus. The sutures can then be tied and buried, either under a lamellar scleral incision groove or scleral flap, or in the fashion of a mattress suture as shown in **Figure 2f**.

References

1. *Ram J, Apple DJ, Peng Q, et al. Update on fixation of rigid and foldable posterior chamber intraocular lenses. Part I: elimination of fixation-induced decentration to achieve precise optical correction and visual rehabilitation. Ophthalmology 1999;106:883-890.*
2. *Loya N, Lichter H, Barash D, Goldenberg-Cohen N,*

Strassmann E, Weinberger D. Posterior chamber intraocular lens implantation after capsular tear: ultrasound biomicroscopy evaluation. J Cataract Refract Surg 2001; 27:1423-1427.
3. *Henriksson S, Holm O, Krakau CE. On the apparent size of structures in the anterior chamber. Acta Ophthalmol (Copenh). 1968;46:278-283.*
4. *Smiddy WE, Flynn HW Jr. Management of dislocated posterior chamber intraocular lenses. Ophthalmology 1991;98: 889-894.*
5. *Mello MO Jr, Scott IU, Smiddy WE, et al. Surgical management and outcomes of dislocated intraocular lenses. Ophthalmology 2000;107:62-67.*
6. *Hanemoto T, Ideta H, Kawasaki T. Luxated intraocular lens fixation using intravitreal cow hitch (girth) knot. Ophthalmology 2002;109:1118-1122.*
7. *Smiddy WE. Modification of scleral suture fixation technique for dislocated posterior chamber intraocular lens implants. Arch Ophthalmol 1998;116:967.*
8. *Friedberg MA, Berler DK. Scleral fixation of posterior chamber intraocular lens implants combined with vitrectomy. Ophthalmic Surg 1992;23:17-21.*
9. *Maguire AM, Blumenkranz MS, Ward TG, Winkelman JZ. Scleral loop fixation for posteriorly dislocated intraocular lenses. Operative technique and long-term results. Arch Ophthalmol 1991;109:1754-1758.*
10. *Kwok AK, Cheng AC, Lam DS. Surgical technique for transcleral-fixation of a dislocated posterior chamber intraocular lens. Am J Ophthalmol 2001;132:406-408.*
11. *Seo MS, Yoon KC, Yang KJ, Park YG. A new technique for repositioning a posteriorly dislocated intraocular lens. Ophthalmic Surg Lasers 1998;29:147-150.*
12. *Lewis H, Sanchez G. The use of perfluorocarbon liquids in the repositioning of posteriorly dislocated intraocular lenses. Ophthalmology 1993;100:1055-1059.*
13. *Chan CK. An improved technique for management of dislocated posterior chamber implants. Ophthalmology 1992; 99:51-57.*
14. *Thach AB, Dugel PU, Sipperley JO, et al. Outcome of sulcus fixation of dislocated posterior chamber intraocular lenses using temporary externalization of the haptics. Ophthalmology 2000;107:480-484.*

Comments

by Dr Ronald Yeoh, Singapore National Eye Center, 11 Third Hospital Avenue, Singapore 168751, Singapore.

This case is instructive from the point of view of why the nucleus dropped and how it might have been prevented.

Two things are suggested by the history: firstly that the cataract is probably a posterior polar cataract with an inherently weak posterior capsule; and secondly that there was a hydrorupture of the posterior capsule predisposing to the dropped nucleus.

Hydrodissection in the presence of a posterior polar cataract is hazardous because the fluid wave is likely to burst through the posterior capsular weakness. In this case, it is likely that the capsule was ruptured by just such an event. Posterior polar cataracts should not be hydrodissected; hydrodelamination is a safer option, ensuring that the fluid wave is remote from the posterior capsule.

It would be unusual for the nucleus to drop immediately following the hydrodissection, notwithstanding the presence of a posterior capsular defect. The nucleus usually drops when the phacotip is inserted and the anterior chamber is pressurized.[1,2]

Hydrorupture of the posterior capsule can also occur during normal hydrodissection if excessive force is used in the presence of a large nucleus and a small capsulorhexis. One physical sign of this complication is the 'pupil snap' sign of hydrorupture of the posterior capsule, which was described some years ago.[2] The observation of this sign means that there is a significant risk of a dropped nucleus and an inexperienced surgeon would be well advised to seek help or to convert to manual removal of the nucleus. Hydrorupture of the posterior capsule can be considered as a complication of intraoperative capsular block syndrome wherein the resistance to hydrodissection particularly in cases with small capsulorhexes and large nuclei are concerned.[3,4]

Posterior capsular ruptures may be classified into the following categories: prenuclear (during capsulorhexis and hydrodissection), perinuclear (during nuclear phacoemulsification or division) and postnuclear (during irrigation/aspiration and IOL insertion). Both prenuclear and perinuclear ruptures may be associated with the dreaded dropped nucleus but, in my experience, it occurs more commonly in the former because the posterior capsular rupture is frequently undetected. In a perinuclear rupture, one is usually immediately aware of the rupture and steps may be taken to avoid the dropped nucleus

It was reasonable to implant the polymethyl methacrylate lens into the sulcus because the anterior capsular rim appeared to be intact. However, the fact that the IOL subsequently dislocated suggests that there may also have been some zonular damage that was undetected. The dislocated posterior chamber IOL would need to be retrieved by a vitreoretinal surgeon and either sutured into place or entirely removed to be replaced by an anterior chamber lens implant.

References

1. *Ota I, Miyake S, Miyake K. Dislocation of the lens nucleus into the vitreous cavity after standard hydrodissection. Am J Ophthalmol 1996;121:706-708.*
2. *Yeoh R. The 'pupil snap' sign of posterior capsule rupture with hydrodissection in phacoemulsification. Br J Ophthalmol 1996,80:486.*
3. *Miyake K, Ota I, Ichihashi S, Miyake S, Tanaka Y, Terasaki H, New classification of capsular block syndrome. J Cataract Refract Surg 1998;24:1230-1234.*
4. *Yeoh R, Theng J. Capsular block syndrome and pseudoexpulsive hemorrhage. J Cataract Refract Surg 2000;26: 1082-1084.*

Comments

by Dr Tarun Sharma, Head of Department, Shri Bhagwan Mahavir Vitreoretinal Services, Sankara Nethralaya, Vision Research Foundation, Chennai, India.

This case report narrates an intraoperative complication of posteriorly dislocated nucleus after hydrodissection and its management. Another issue is the dislocation of the intraocular lens in the immediate postoperative period. My comments on this interesting case are as follows:

Anticipation and prevention of posterior dislocation of the nucleus

Patients with dense posterior subcapsular plaques carry a high risk of posterior capsular rupture during hydrodissection, therefore, surgeons should be extremely cautious at this stage of the procedure. If possible, one might consider avoiding hydrodissection in patients with posterior polar cataracts. Extreme caution and care should be taken to avoid the occurrence of this complication in the fellow eye, which also has dense posterior subcapsular plaque.

Management of posterior dislocation of the nucleus

From the enclosed reports, it is not possible to judge the hardness of the dislocated nucleus. However, in our practice, we remove the posteriorly dislocated lens through fragmentation after completion of pars plana vitrectomy; preferring not to open the limbus to deliver the whole nucleus as was done for this patient. Delivering the nucleus from the vitreous cavity through capsulorhexis into the anterior chamber could have resulted in zonular dialysis — a reason for IOL dislocation on the second postoperative day.

Further management

Ultrasound biomicroscopy will help in assessing zonular apparatus. If there is sufficient dialysis (>180°), in particular inferiorly, IOL repositioning into the sulcus will be avoided. Another option is to remove the posteriorly dislocated IOL and replace it with a scleral-fixated IOL.