'Layer by layer' phacoemulsification in posterior polar cataract with pre-existing posterior capsular rent

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Abstract

Purpose To evaluate a new technique of 'Layer by Layer' phacoemulsification in eyes with posterior polar cataract with pre-existing posterior capsular rent (PCR).

Methods Layer by layer phacoemulsification was performed in eight eyes of eight patients of posterior polar cataract with pre-existing posterior capsular rent. All the patients had evidence of a posterior capsular defect showing presence of iridescent refractile lens particles in vitreous with onion skinning of central dense plaque.

Results The mean age of the patients was 43.75 ± 2.5 years and six patients were men. All the eyes had vertical posterior capsular defect irrespective of the site of entry of phaco probe. Vitrectomy was not required in any of the eyes. Single piece foldable acrylic intraocular lens was implanted in the bag in all the eyes. The mean preoperative best corrected visual acuity was 0.14 ± 0.05 , which improved to 0.77 ± 0.27 .

Conclusion Our technique of 'Layer by layer' phacoemulsification is an effective and safe technique for the management of posterior polar cataract with pre-existing PCR.

Eye (2008) 22, 1008–1010; doi:10.1038/sj.eye.6702795; published online 6 April 2007

Keywords: posterior polar cataract; layer by layer phacoemulsification; posterior capsular rent

Introduction

Posterior polar cataract is a clinically distinct entity characterized by a central dense disk-shaped opacity located on the posterior capsule.

The capsule around the opacity is generally weak that enhances the possibility of posterior capsule rupture (PCR).^{1,2} Performing phacoemulsification in such a situation is a surgical challenge. The defect may cause premature rupture of the capsule during hydrodissection or nuclear emulsification, or rupture may occur spontaneously if the chamber flattens during surgery. If there is a pre-existing posterior capsular defect, it may enlarge suddenly and the nucleus with cortical matter may drop down posteriorly into the vitreous cavity. We performed a prospective study to report a new surgical technique of phacoemulsification in cases of posterior polar cataract with pre-existing PCR.

Methods

Eight patients with posterior polar cataract and pre-existing posterior capsular defect were included in the study. All the patients had evidence of posterior capsular defect in the form of iridescent refractile lens particles in anterior vitreous and onion skinning of central dense plaque.^{1,2} A thorough evaluation of the patients was performed, which included uncorrected visual acuity, best corrected visual acuity, slit-lamp biomicroscopy for anterior segment evaluation particularly the extent of cataract and the status of posterior capsule along with the evidence of pre-existing posterior capsular defect, intraocular pressure, and fundus evaluation to rule out the presence of any associated retinal pathology. Keratometry was performed using Bausch and Lomb keratometer, and the axial length was measured using an A scan biometer (Appasamy Associates, Chennai, India). The power of the

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Received: 25 July 2006
Accepted in revised form: 13 February 2007
Published online: 6 April 2007

intraocular lens was calculated in all the patients using SRK II (Sanders, Retzlaff, Kraff) formula.

Surgical technique

All the surgeries were performed by a single surgeon (RBV) under topical anaesthesia using 0.5% proparacaine. A 3.2-mm clear corneal tunnel was created in the steeper meridian. The anterior chamber was formed with 1.4% sodium hyaluronate (Healon GV[®], AMO Inc., Santa Ana, CA, USA). Two side ports were created at two clock hour positions away from the main tunnel with the microvitrectomy blade. A central curvilinear capsulorhexis of 5.0–5.5 mm in size was created with a bent 26 gauge $\frac{1}{2}$ inch needle. Cortical cleavage hydrodissection was not performed. The cannula for hydroprocedure was introduced into the superficial lens cortex and epinucleus, and fluid was injected at the layer of first resistance to the movement of the cannula. The inner nucleus was thus dissected from the superficial lens cortex and epinucleus by this procedure of hydrodelineation. Completion of hydrodelineation was ensured by the formation of a single golden ring. Slow motion phacoemulsification was performed with low irrigation (bottle height 60 cm), low flow rate (15–20 cc/min), and low vacuum (60–80 mm Hg). Sculpting of the central part of the nucleus was performed. After a moderate central sculpting, the inner nuclear core was held with the phaco probe and chopped into two pieces using a phaco chopper with a blunt ball tip (Appasamy associates, Chennai, India). One of the pieces was detached from the epinucleus with the help of a blunt chopper and held with the phaco probe. This piece was again chopped into two pieces and emulsified. Similarly the other piece was also emulsified. After removal of the inner firm nucleus, each layer of epinucleus and cortex was sequentially aspirated in layers by an automated bimanual irrigation and aspiration cannula (Figure 1). The wedge-shaped cortical material was gradually aspirated till the central area of the posterior polar cataract was reached. The cortical material was separated, from approximately 3–4 mm outside the central area, with the aid of a blunt chopper. This manoeuvre of mechanical separation from the central plaque avoids traction or pull, which may otherwise be generated from attempting to directly aspirate the cortical matter. The penultimate layer was carefully aspirated (Figure 2) leaving a posterior thin layer of cortex adherent to the capsule. The most posterior layer along with the plaque was then viscodissected (Figure 3) and aspirated using bimanual irrigation and aspiration cannula. In all the eyes, a vertical PCR was noticed immediately after the plaque was peeled off. Healon GV[®] (AMO Inc., Santa Ana, CA,

Figure 1 Layer by layer emulsification and aspiration of the epinucleus and cortical material.

Figure 2 Aspiration of the penultimate cortical layer.

USA) was injected into the peripheral part of the capsular bag. An acrylic (Acrysof, MA60BM, Alcon Laboratories Inc., Fortworth, TX, USA) foldable intraocular lens was implanted into the capsular bag. The residual viscoelastic was gently aspirated using a left-handed Simcoe cannula, and the corneal tunnel was hydrated with balanced salt solution.

Postoperatively, patients were prescribed topical betamethasone sodium phosphate 0.1% and ciprofloxacin 0.3% QID each, for 3 weeks and tropicamide 1% TID for 1 week.

Results

The mean age of the patients was 43.75 ± 2.5 years and six patients were men. All the eyes had a vertical posterior capsular defect irrespective of the site of entry of the

Figure 3 Viscodissection of the most posterior cortical layer.

phaco probe. Vitreous face was intact in all the eyes and anterior vitrectomy was not performed in any of the eyes. Single piece foldable acrylic intraocular lens could be implanted successfully in the bag in all the eyes. The mean preoperative best corrected visual acuity was 0.14 ± 0.05 , which improved to 0.77 ± 0.27 . One patient (12.50%) developed cystoid macular oedema that was detected clinically at 4 weeks after surgery.

Discussion

Phacoemulsification in a posterior polar cataract is a challenge to the anterior segment surgeon. Many surgical innovations and modifications have been tried to prevent complications in the surgery. Most surgeons believe that the turbulence in the anterior chamber during the surgery should be minimum.²⁻⁴ Slow motion phacoemulsification technique has been recommended to achieve better control by reducing the turbulence in the anterior chamber.^{5,6}

The aim of the surgical technique in such cases is not to overpressurize the anterior chamber or capsular bag, thereby to prevent posterior capsule rupture.⁷ Hydrodissection is contraindicated and hydrodelineation alone is performed. Nuclear rotation is avoided as any attempt to rotate the nucleus can lead to capsular rupture. Nuclear emulsification is performed by direct chopping, in the presence of a harder nucleus, multiple, small fragments of the nucleus are created by using step-by-step chop *in situ* and lateral separation.⁸

After completion of nuclear emulsification, viscodissection is performed to mobilize the epinucleus and cortex in such situations.³ A posterior layer of the lens cortex is preserved over the posterior polar region till the conclusion of the emulsification procedure to

minimize the risk of loss of lens material into the vitreous cavity through the capsular defect.⁴ Masket⁹ has also suggested that the central area should be kept attached until the last stage of cortical aspiration.

The advantage of our technique of 'layer by layer' phacoemulsification is the availability of an adequate cushion throughout the procedure of debulking of the nucleus. As the technique involves aspiration of each layer of epinucleus and cortex separately, the visibility of the posterior-most cortical layer adherent to the margins of the posterior capsular defect is enhanced. The posterior cortical layer, which is adherent to the posterior capsule is removed in the end using bimanual irrigation-aspiration cannula causing minimal turbulence in the anterior chamber as well as the anterior hyaloid face after opening up of the posterior capsular defect. As there is no disturbance of the anterior hyaloid face by this technique, it obviates the need for anterior vitrectomy; however, vitreous loss may not be totally ruled out owing to the use of intraocular irrigation to remove the cortical matter. Further, as the remaining part of the capsular bag is intact, the intraocular lens can be successfully implanted in the bag.

Hence, this technique of 'layer by layer' phacoemulsification may be a good option in eyes with posterior polar cataract with pre-existing posterior capsular defect. However, a larger series may be desired to establish the technique.

References

- 1 Osher RH, Yu BC, Koch DD. Posterior polar cataracts: a predisposition to intraoperative posterior capsular rupture. *J Cataract Refract Surg* 1990; **16**: 157-162.
- 2 Vasavada A, Singh R. Phacoemulsification in eyes with posterior polar cataract. *J Cataract Refract Surg* 1999; **25**(2): 238-245.
- 3 Allen D, Wood C. Minimizing risk to the capsule during surgery for posterior polar cataract. *J Cataract Refract Surg* 2002; **28**: 742-744.
- 4 Fine IH, Packer M, Hoffman RS. Management of posterior polar cataract. *J Cataract Refract Surg* 2003; **29**(1): 16-19.
- 5 Osher RH. Slow motion phacoemulsification approach [letter]. *J Cataract Refract Surg* 1993; **19**(5): 667.
- 6 Vajpayee RB, Sharma N, Dada T, Gupta V, Kumar A, Dada VK. Management of posterior capsule tears. *Surv Ophthalmol* 2001; **45**(6): 473-488.
- 7 Kunert KS, Bhartiya P, Dada T, Vajpayee RB. Layer-by-layer phacoemulsification in posterior polar cataracts. XIX Congress of the ESCRS. Amsterdam, 2001.
- 8 Vasavada AR, Singh R. Step-by-step chop *in situ* and separation of very dense cataracts. *J Cataract Refract Surg* 1998; **24**: 156-159.
- 9 Masket S. Consultation section. *J Cataract Refract Surgery* 1997; **23**: 819-824.