Preoperative 532 double frequency YAG anterior capsulotomy in hypermature cataracts

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The Journal of the College of Ophthalmologists of Sri Lanka 2020; 26: 26-28

Introduction

Phacoemulsification in hyper-mature cataracts is a challenge due to high intra-lenticular pressure, resulting in the capsulorhexis extending to the periphery. A continuous curvilinear capsulorhexis (CCC) is crucial to uncomplicated, safe and successful phacoemulsification and posterior chamber intraocular lens (IOL) implantation. Achieving a CCC in eyes with white hyper-mature cataract is challenging due to high intra-lenticular pressure and risk of extension of capsulorhexis (Argentinian flag sign)[1,2]. Various techniques such as double capsulorhexis, phaco-capsulorhexis, massaging, anterior capsular puncture with a needle or YAG laser and femtosecond laser capsulorhexis have been described to prevent this complication[4-9].

Objective

The objective of this study is to describe the use of preoperative double frequency YAG laser anterior capsulotomy, prior to phacoemulsification in eyes with white intumescent cataracts in terms of the intra-operative difficulties and postoperative outcomes.

Methodology

This study comprised 12 eyes of 12 patients with white hypermature cataracts operated from 15th of August to 30th of September 2021. Patients with history or signs of other ocular diseases, such as glaucoma, uveitis, lens subluxation, pseudoexfoliation, Fuchs heterochromic iridocyclitis, unhealthy cornea or diabetic retinopathy were not selected for the study. Patients with shallow anterior chamber on slit lamp examination (Van Herick's technique: if the anterior chamber depth is less than ¼ of the corneal thickness at the limbus) were also excluded. All eyes to be operated were able to appreciate the cobalt blue light of the slit lamp. Slit lamp examination findings, applanation tonometry and biometry details were recorded preoperatively.

The patients were explained the details of the surgery and the consent was taken preoperatively. The pupils were dilated with commercially available tropicamide 0.8% and phenylephrine 5% combination eye drops. The intraocular pressure was recorded just before making a preoperative central anterior capsular hole using the 532 double frequency YAG laser with a single laser spot at 1.8mJ. The intraocular pressure was measured immediately after and 10 minutes after the laser. The surgery was performed around one hour after the laser capsulotomy. After YAG laser capsulotomy all the eyes developed a visible milky liquefied cortical material leaking into the anterior chamber (Figure 1). The capsular opening could be seen clearly after use of 0.1% trypan blue during surgery (Figure 2). All surgeries were performed by the same surgeon using topical anaesthesia, temporal incision with 2.2 slit knife (Alcon surgical) and 0.8mm side port incision (Alcon surgical), tryphan blue for capsular staining, Sodium hyaluronate and methyl cellulose as OVDs and "Stop and Chop" technique.

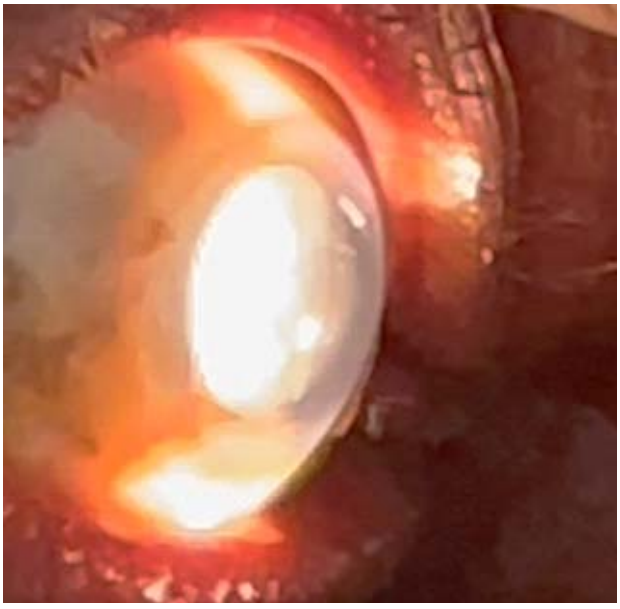

Figure 1. *Pooling of liquified cortical matter in the anterior chamber.*

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Figure 2. *Central anterior YAG capsular tear.*

After the main incision the anterior chamber was irrigated with Shugarcaine solution (1ml of 1:1000 adrenaline, 3 ml of 2% xylocaine and 6 ml of BSS) and 1% tryphan blue was injected into the anterior chamber followed by methylcellulose injection. A small irregular anterior capsular rupture was noted in all twelve cases. A CCC was made using a capsulorhexis forceps. No hydro-dissection was performed. A routine "stop and chop" technique phacoemulsification using the "Alcon Centurion" phaco machine and posterior chamber intraocular lens implantation was performed. The phaco-metrics were recorded after each surgery. The patients were examined on the first day and two weeks after the surgery. The status of the cornea, intraocular pressure and the visual acuity was recorded on both visits.

Results

The male: female ratio of the sample was 7:5 and age range was from 34 to 72 with a mean of 57 years. The visual acuity was 6/9 or better in all patients on the first and second visits except one patient whose vision was 6/12 with a preexisting astigmatism of 0.75D at 90°. His corrected vision was 6/6 on the second visit. The cornea was clear in all patients on day one postoperatively.

The IOL power ranged from 20D to 22.5D. The average total case time was 4.73 minutes (lowest 2.41 and the highest 8.14 minutes), average total U/S time 1.24 minutes. The average total estimated fluid aspirated per case was 59ml.

The intraocular pressure (IOP) of the patients just before the YAG laser was between 14mmHg to 21mmHg with a mean 17.42 mmHg. The IOP immediately after the YAG capsulotomy ranged from 16 to 26 with a mean of 20.92 mmHg. The mean rise of the IOP after YAG laser capsulotomy was 3.50 mmHg. The difference of IOP values immediately after and 10 minutes after YAG capsulotomy was not significant.

The post op day one intraocular pressure ranged from 12 to 18 mmHg with a mean of 15.67 mmHg. The two weeks post-op IOP was not different significantly compared to the values of the day one post-op. The mean IOP reduction from pre phaco to post phaco was 1.75mmHg.

Patient No.	*Pre-YAG IOP mmHg*	*Immediately after YAG IOP mmHg*	*10 minutes after YAG IOP mmHg*	*Post op day 1 IOP mmHg*
1	16	20	20	14
2	18	21	21	16
3	14	16	18	14
4	20	26	26	18
5	18	20	20	16
6	18	21	21	16
7	16	19	19	16
8	14	18	20	12
9	21	26	26	18
10	20	24	24	18
11	16	20	20	14
12	16	20	21	15
Mean	17.42	20.92	20.5	15.67

Discussions

The hypermature or white cataract does not represent a homogenous group of cataracts. Examination under the slit-lamp, with special attention on the cortical areas, capsule, red reflex, perception of the light or the vision, anterior chamber depth and A-scan measurement of the lens provides clues to the exact nature of the cataract. The previous history of trauma, mobility of the lens, calcification and the deep socket need an extra care in deciding the plan of the surgery. One of the main challenge of surgery in a white cataract, is how to determine which cataracts are intumescent, with high intra-capsular pressure, and how to prevent the extension of capsulorhexis to the periphery[9], intraoperatively in these cases.

In many cases the opening of the anterior capsule at the beginning of the capsulorhexis leads to the leaking of the milky like liquified cortical material, as well as intraoperative features like observation of visible milky liquefied cortex after starting the anterior capsulotomy are determinants for the correct diagnosis and define if the white cataract is intumescent[10].

The extension at the beginning of the capsulorhexis is known as "Argentinian flag sign" which makes the surgery a challenge. To overcome this complication, Gimbel and Willerscheidt originally suggested the two stage CCC approach with a small capsulorhexis or a puncture of the anterior capsule before capsulotomy[11]. After the intra-lenticular pressure is reduced the small CCC was enlarged to the desired diameter. With this technique, CCC was achieved in 57 eyes (95%)[8]; but other authors reported a 28.3% incidence of incomplete capsulorhexis[12], with a very low success rate in white cataracts with a liquefied cortex (68%) compared to those with a solid cortexv[13].

CCC can also be performed in a sealed anterior chamber[8] using a 27 or 30 gauge needle mounted on a 2.5 ml syringe filled with BSS. Another report described the successful preoperative use of Nd: YAG laser capsulotomy in the presence of an intact anterior chamber[9]. Both techniques may maintain an equal distribution of vector forces, preventing uncontrolled splitting of the anterior capsule to the periphery. In the closed anterior chamber, a central hole of the anterior capsule of the lens causes leaking of cortex, causing rise of the chamber pressure while rapid reduction of the intra-lenticular pressure. Therefore, the pressure in both compartments reach to equilibrium, preventing anterior displacement of the nucleus that otherwise causes the extension of the capsular tear or even if a slight anterior displacement of the nucleus occurs it may not be adequate to cause the extension of the capsular tear. The slow absorption of the material from the anterior chamber results in gradual release of the remaining cortex from the intra-lenticular compartment.

Conclusion

A central anterior capsular hole using YAG laser is an alternative safe technique to facilitate capsulorhexis in white mature cataract. This is more important in the case of lenses with zonular weakness such as pseudoexfoliation or subluxated lenses where massaging may not be a safe option.

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