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A novel minimal fluid technique for effective and safe lens hydrodissection during cataract surgery

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Abstract:

Traditional hydrodissection may cause posterior capsule rupture (PCR) if excessive fluid accumulates. In this study, we describe the successful application of a novel minimal fluid hydrodissection technique in 100 consecutive cataract surgery cases. This technique separates the nucleus from the capsule utilizing low hydrostatic pressure and precise kinetic movement of a small volume (around 0.2 cc) of balanced salt solution. There were no instances of PCR. This technique is suitable for a range of cases, including femtosecond laser-assisted cataract surgery and posterior subcapsular cataract.

Keywords:

Capsular block syndrome, cataract surgery, hydrodissection, minimal fluid technique, phacoemulsification, posterior capsule rupture

Introduction

Traditional hydrodissection and rotation of the lens nucleus are easily performed during most cataract surgeries. However, the risk of intraoperative capsular block syndrome has been reported during hydrodissection for the femtosecond laser-assisted cataract surgery (FLACS).[1-3] Posterior capsule rupture (PCR) can occur because of increased intracapsular volume when intracapsular gas is produced during overvigorous hydrodissection. Further, surgeons must be careful not to use an unnecessarily large volume of balanced salt solution (BSS) or excessively repeat hydrodissection procedures because these may cause PCR, as evidenced by sudden marked pupillary constriction (the pupil snap sign).[4] These precautions are particularly important in complex cases such as posterior subcapsular cataract. Surgeons will generally prefer not to perform hydrodissection in such cases because of the risk of PCR, which may be as high as 11%–36%.[5]

The minimal fluid hydrodissection technique described here is a novel procedure that can be used in all cataract cases. It involves the precise injection of a minimal amount of BSS (approximately 0.2 cc) to one side of the lens equator. This small injection separates the nucleus from the capsule, utilizing low hydrostatic pressure, and precise kinetic movement of the fluid during hydrodissection for both challenging and regular cases.

Methods

Patients

To assess the safety and efficacy of this technique, we reviewed 100 consecutive eyes that underwent phacoemulsification with intraocular lens (IOL) implantation at the Universal Eye Center, Zhongli, Taiwan, from September to November 2018. Ocular conditions at surgery included posterior subcapsular cataract in 15 eyes, and 31 eyes were treated using FLACS. Hydrodissection was performed in all cases as described. The average BSS volume was 0.18 ± 0.07 (0.06–0.35) mL, and there were no instances of PCR.

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Surgical technique

Following continuous curvilinear capsulotomy (CCC), the main incision was compressed to release a small amount of Viscoat and lower the intraocular pressure, which was initially increased to maintain the anterior chamber depth during CCC. Reduction of the intraocular pressure will make the eyeball softer and facilitate hydrodissection. For this minimal fluid technique, hydrodissection was divided into four steps as follows:

Step 1: Cleavage of the cortex from the posterior capsule

A single-point BSS injection was employed. First, a 27G cannula was inserted under the anterior capsule by slightly lifting the capsulorrhexis edge upward. Second, BSS was quickly injected to generate hydrostatic force sufficient for a fluid wave to pass across the posterior aspect of the lens [Figure 1a]. The force was proportional to the rate of flow and cannular resistance. A 1-mL syringe is a good choice to provide tactile feedback of the flow rate; however, surgeons with less hand strength may prefer a 3-mL syringe.

Step 2: Termination of injection once the hydrodissection wave has completely crossed the lens equator

The injection was stopped when the fluid wave was transmitted across the posterior aspect of the lens and passed close to the lens equator [Figure 1b]. In some cases, a slight forward bulge of the lens was noted, indicating that a large volume of BSS had accumulated between the lens and the posterior capsule. If this injected fluid cannot easily escape, then the fluid wave may increase the pressure within the capsular bag to an unsafe level and cause PCR. The intraoperative capsular block may occur due to the accumulation of BSS between the posterior capsule and the lens nucleus. This situation can induce PCR, causing the lens to drop into the vitreous chamber.

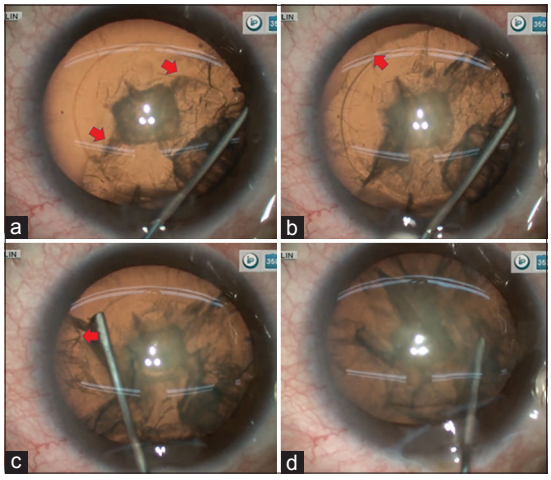

Figure 1: The demonstration of minimal fluid hydrodissection technique. (a) A 27G cannula was inserted under the anterior capsule by slightly lifting the capsulorrhexis edge upward. The balanced salt solution was quickly injected to generate hydrostatic force sufficient for a fluid wave (red arrows) to pass across the posterior aspect of the lens. (b) The injection was stopped when the fluid wave was transmitted across the posterior aspect of the lens and passed close to the lens equator (red arrow). (c) Gentle depression of the lens was performed to separate the nucleus from the anterior capsule and to force out excess fluid (red arrow). (d) The cannula tip was passed under the right edge of the nucleus to slightly lift it up above the anterior capsule plane. This maneuver separated the peripheral cortex from the inner cortex

Step 3: Use of the cannula tip to gently depress the lens

Gentle depression of the lens was performed to separate the nucleus from the anterior capsule and to force out excessive fluid [Figure 1c]. Separation of the cortex from the posterior and anterior capsule along the equator allows fluid to exit from the capsular bag through the capsulorrhexis. This action can reduce BSS volume in the weakened central area and release the equatorial part of the lens from the capsule.

Step 4: Rotation of the lens nucleus within the capsular bag using the cannula tip

The nucleus was rotated counterclockwise around a fixed central point within the capsule by visualizing an imaginary point on the lens axis. The cannula tip was passed under the right edge of the nucleus to slightly lift it up to above the anterior capsule plane. This maneuver separated the peripheral cortex from the epinucleus [Figure 1d].

Regular cataract surgery procedures, including phacoemulsification and IOL implantation, were performed following this modified hydrodissection technique [Video 1].

Discussion

PCR is a serious complication in regular cataract surgery, occurring in 1.92%–2.09% of all phacoemulsification procedures.[6,7] The traditional hydrodissection technique of injecting a large amount of BSS to separate the lens nucleus from the cortex and capsule causes a buildup of BSS at the posterior capsule pole. This fluid buildup and the ensuing intracapsular pressure elevation increase the risk of PCR, which in turn causes the lens nucleus to drop into the vitreous chamber.

The minimal fluid hydrodissection technique described here has a relatively brief learning curve. It may be used in various cases and is particularly useful for managing intraoperative floppy iris syndrome, pseudoexfoliation syndrome, rock hard cataracts, white cataracts, small pupil cataracts, and cases with posterior subcapsular cataract.

The tilt and tumble technique of phacoemulsification involves the use of pressure from a hydrodissection wave to prolapse a pole of the lens nucleus out of the capsular bag.[8] Once the rhexis is completed, a hydrodissection

cannula is used to support the capsular rim, and a continuous fluid wave is used to irrigate the subcapsular space. As the wave travels forward, the pressure behind the nucleus increases and causes the opposite nuclear pole to tilt out of the rhexis rim. However, if the pole does not prolapse out, then additional attempts at hydrodissection may cause PCR because of excessive BSS accumulation.

Using the minimal fluid hydrodissection technique, BSS was not used to separate the lens nucleus from the cortex and capsule in a single step. Rather, a minimal amount of BSS was injected at one side of the lens equator, and the lens nucleus was separated from the cortex and capsule in the following four steps: separate the cortex from the posterior capsule, terminate the injection once the hydrodissection wave completely crosses the lens equator, gentle depression of the lens using the cannula tip, and rotate the nucleus within the capsular bag using the cannula tip.

Conclusions

This minimal fluid hydrodissection technique has been safely and effectively used in 100 consecutive cataract surgeries, including 31 using FLACS, and all procedures were performed without the occurrence of intraoperative PCR. The technique requires only a small volume of BSS during hydrodissection (0.18 ± 0.07 mL) [Video 2], thereby preventing unsafe intracapsular pressure elevation and requires no special instruments. The technique is useful in various cases, including complex and regular cataract surgeries.

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Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

References

1. Yeoh R. Hydrorupture of the posterior capsule in femtosecond-laser cataract surgery. J Cataract Refract Surg 2012;38:730.
2. Masuda Y, Iwaki H, Watanabe A, Takada A, Okamoto T, Oki K, *et al.* The safety and efficacy of phaco-sleeve irrigation-assisted hydrodissection during femtosecond laser-assisted cataract surgery. Clin Ophthalmol 2018;12:1829-35.
3. Roberts TV, Sutton G, Lawless MA, Jindal-Bali S, Hodge C. Capsular block syndrome associated with femtosecond laser-assisted cataract surgery. J Cataract Refract Surg 2011;37:2068-70.
4. Yeoh R. The 'pupil snap' sign of posterior capsule rupture with hydrodissection in phacoemulsification. Br J Ophthalmol 1996;80:486.
5. Johnston RL, Taylor H, Smith R, Sparrow JM. The cataract national dataset electronic multi-centre audit of 55,567 operations: Variation in posterior capsule rupture rates between surgeons. Eye (Lond) 2010;24:888-93.
6. Arbisser LB. Faculty of 1000 Evaluation for Decreasing Rate of Capsule Complications in Cataract Surgery: Eight-Year Study of Incidence, Risk Factors, and Data Validity by the Swedish National Cataract Register. F1000 – Post-Publication Peer Review of the Biomedical Literature; 2011.
7. Arshinoff SA. Faculty of 1000 Evaluation for One Million Cataract Surgeries: Swedish National Cataract Register 1992-2009. F1000 – Post-Publication Peer Review of the Biomedical Literature; 2011.
8. Davis EA, Lindstrom RL. Tilt and tumble phacoemulsification. Dev Ophthalmol 2002;34:44-58.