

Curative Effect of Cataract Phacoemulsification with Iris Posterior Synechia

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Abstract: *Background:* Uveitis can cause blindness if not be appropriately managed. Anterior segment is common and frequent site in uveitis, can result in different degrees iris posterior synechia, iris depigmentation and atrophy, earlier form of cataract, etc. Surgery of cataract is complicated and prone to inflammatory reaction, especially in patients who involve anterior and posterior segment. Better operation technique and gentle maneuver is very important in such surgery. *Aim:* To investigate the application of phacoemulsification with IOLs implantation in cataract surgery with posterior synechia of the iris, and analyze its clinical effect. *Methods:* 36 cases (45 eyes) were enrolled from March 2019 to October 2020, diagnosed with chronic uveitis complicated cataract, treated with phacoemulsification combined with implantation of intraocular lens. Postoperative visual acuity and complications during operation were recorded. *Results:* Postoperative day 1, the best corrected visual acuity (BCVA) of 25 eyes (55.6%) were no less than 0.5, 14 eyes (31.1%) were 0.3~0.5, 6 eyes (13.3%) were 0.1~0.25; Anterior chamber inflammation emerged in 9 eyes (20.0%), more severe and recurrence of iris posterior synechia in 8 eyes (17.8%), pigmentation lost on IOLs in 7 eyes (15.6%). Intraocular pressure (IOP) after operation was 14.35 ± 9.43 mmHg (11 eyes were above normal, 6.0~25.0 mmHg), no significance difference with preoperation IOP ($t=0.25$, $p=0.80$). No infectious endophthalmitis was found. 1 week after operation, the BCVA of 30 eyes (66.7%) were no less than 0.5, 13 eyes (28.9%) were 0.3~0.5, 2 eyes (4.4%) were 0.1~0.25. Anterior chamber inflammation disappeared in all cases, 4 eyes (8.9%) with iris posterior synechia couldn't be debonded, 3 eyes (6.7%) with iris dystrophy. Average IOP was 11.27 ± 6.81 mmHg, no significance difference with preoperation IOP ($t=0.46$, $p=0.65$). 1 month after operation, the BCVA of 30 eyes (66.7%) no less than 0.5, 13 eyes (28.9%) were 0.3~0.5, 2 eyes (4.4%) were 0.1~0.25. IOP (10.92 ± 5.94 mmHg) was stable, and no significance difference with preoperation IOP ($t=0.51$, $p=0.61$). 3 months after operation, the BCVA of 33 eyes (73.3%) were no less than 0.5, 10 eyes (22.2%) were 0.3~0.5, 2 eyes (4.4%) were 0.1~0.25. IOP (11.06 ± 5.71 mmHg) was no change as preoperation ($t=0.67$, $p=0.51$). 4 (8.9%) and 3 (6.7%) eyes with iris posterior synechia and iris dystrophy respectively. *Conclusion:* Phacoemulsification and intraocular lens implantation may be effective in the cataract surgery with iris posterior synechia, and timely management of possible complications after surgery maybe helpful for clinical outcomes.

Keywords: Uveitic Cataract, Phacoemulsification, Cataract Surgery, Inflammation Recurrence

1. Introduction

Uveitis is one of the major causes of blindness worldwide [1, 2], and cataract formation is one of the most frequent complications that occur in patients with uveitis. Cataract develops earlier than common people, mainly due to chronic intraocular inflammation and adverse effects of long-term corticosteroid treatment [3], are prone to higher intraocular pressure, iris posterior synechia and iris dystrophy, etc. As we know, cataract patients with uveitis are at high risk of

operation accidents and postoperative complications, such as iris damage, big pupil, iris hemorrhage, macular edema, consequent visual loss [4] and posterior capsular opacification (PCO) [5], etc. And the rate of posterior capsular rupture (PCR) in cataract surgery varies from 0.49% to 4.6%, zonular dialysis (ZD) ranges from 0.09% to 0.26% [6, 7], and they are unique challenges for surgeons' technique and experience. Whereas considering its speciality and difficulty, successful surgery on cataract may get better results in most patients, and it is crucial to deal with complicated abnormal anterior

structure properly. Successful surgery stems from educated patient selection, careful surgical technique, and aggressive preoperative and postoperative control of inflammation. Meticulous and careful cataract surgery in uveitic cataract is essential in optimizing the postoperative outcome. Uveitis recurrences after surgery should be carefully observed, and proper management is crucial to the success of cataract surgery outcomes [8].

PURPOSE: Aim is to study the application of phacoemulsification in cataract surgery with posterior synechia of the iris, and analyze its clinical effect.

2. Materials and Methods

36 cases and 45 eyes of patients with old anterior uveitis complicated with cataract who were treated in our hospital from March 2019 to October 2020 were enrolled, including 21 males and 26 eyes, 15 females and 19 eyes, age was 52.37 ± 6.23 years old (42~69 yrs). The patient's course of illness was 6 months to 24 years, with an average of (6.54 ± 2.46 yrs); 15 patients were diagnosed rheumatism and rheumatoid diseases clearly. Before surgery, we prescribed tobramycin dexamethasone eye drops to anti-inflammatory 4 times a day for 3 days. The contralateral eye surgery should be performed at least one month after the first eye surgery.

2.1. Inclusion Criteria

- A. Old anterior uveitis, without intermediate uveitis and posterior uveitis;
- B. The control of uveitis was stable for more than 6 months;
- C. Cataract with posterior iris adhesion;
- D. Corrected vision was less than 0.3;
- E. Rheumatoid factor (RF), erythrocyte sedimentation rate (CSR), C-reaction protein (CPR) and other related indicators in patients with rheumatism and rheumatoid diseases remain normal for at least 1 month.

2.2. Exclusion Criteria

- A. Those with high intraocular pressure and glaucoma;
- B. There were contraindications to eye and general surgery;
- C. Old uveitis caused by trauma;
- D. Severe fundus diseases that might affect vision.

3. Surgical Procedure

Patients who would undergo cataract surgery must have enough quiescence period, about 6 months [9]. After routine disinfection and draping, with use of the eye sticking film. In the case of protecting the cornea with viscoelastic, we disinfected the conjunctival sac with povidone iodine (0.5%) for 2 minutes and rinsed with much normal saline (about 15~20ml). Made a clear corneal incision 0.5~1.0mm to the limbus at 10 o'clock appropriately, extended the intracorneal stroke and made the incision lip symmetrical as much as

possible. Injected DUOVISC™ viscoelastic agent (Alcon, USA) into the anterior chamber, made a corneal assisted incision at 2 o'clock, and used viscoelastic agent and intraocular lens hook to separate the iris adhering to the surface of the lens bluntly. The movement should be gentle, no special treatment was required with a small amount of bleeding. For the obsolete proliferative membrane in the pupil area that needed to be stripped and removed, the proliferative membrane could be cut with a self-made capsulotomy needle made by a 1ml syringe. The contiguous pieces can be carefully torn off. When the adhesion was tight, used the capsular membrane scissors to cut out as much as possible. Removed the proliferative membrane, but care should be taken not to damage the iris, anterior capsule and other normal tissues. Some patients used the Kuglen hook to penetrate carefully under the contralateral iris and gradually expanded to both sides, directly loosening the adhesion between the iris and the anterior lens capsule. For difficult-to-separate positions, the front end of the Kuglen hook could be used to jam the border of the pupil and push the iris to the periphery to clarify the situation and separate the stubborn adhesion between the iris and the anterior capsule under direct vision. The pupil dilator could be selected when the pupil diameter was less than 3.0mm after separation, or the iris of the pupil might be cut radially, the length was about 2~3mm, 2~3 sites. The anterior chamber was filled with viscoelastic agent again, and the anterior lens capsule was torn apart in a circular, continuous, and centered shape, with a diameter of about 5.5mm. To make the water separation and moisture layer, used Alcon Infiniti phacoemulsifier (Alcon, USA) to emulsify the nuclei and remove them, and clear the remaining cortex. Carefully polished the inner surface around the anterior capsule orifice and the posterior capsule inner surface, injected the viscoelastic agent, and implanted the intraocular lens, completely sucked the viscoelastic agent out from the front and back surfaces of the intraocular lens, pressed backward to touch and stick the posterior capsule. The corneal incision was watertight, and the conjunctival sac was disinfected again to complete the operation. All operations were performed by the same skilled ophthalmologist.

Postoperative observation items: vision acuity, intraocular pressure, cornea, anterior chamber, iris, pupil, intraocular lens, fundus, for continuous three months.

The data was input into the SPSS10.0 for Windows statistical software package and analyzed. The group data of intraocular pressure at different times were compared by paired *t* test, and $P < 0.05$ was considered the difference was statistically significant.

4. Results

4.1. Surgical Situation

All cases were successfully performed phacoemulsification for cataracts, and intraocular lenses were implanted in the first stage. 3 of them (6.7%) used iris

retractor (pupil less than 3mm during operation, Iris Mate-2000, Germany); because some patients could not fully dilate the tension-free iris, 9 eyes (20.0%) completed the operation with the small pupil; the iris was inhaled and damaged by the phaco needle in 2 eyes, and there was no obvious bleeding during the operation. Naraha hook was used to protect the iris, and no serious complications occurred. After the operation, the local pigment of the iris was lost to varying degrees, but it did not affect the sphincter function; 1 eye had a posterior capsule rupture during the operation, the anterior capsule orifice was continuous and centered, and the intraocular lens was implanted in the ciliary

sulcus; The iris were prolapsed from main cornea incision stubbornly in 2 eyes during the operation, and processing it back into the anterior chamber with the help of viscoelastic agent.

4.2. Postoperative Vision

The visual acuity after operation of all patients was significantly improved compared with that before operation.

Visual acuity at different times after surgery (n=36, 45 eyes).

Table 1. Visual acuity at different time after surgery (n=36, 45 eyes).

Time after surgery	VA (LogMAR, N, %)	1 day	1 week	1 month	3 months
≥0.3	NVA	23 (51.1)	26 (57.8)	28 (62.2)	31 (68.9)
	BCVA	25 (55.6)	30 (66.7)	30 (66.7)	33 (73.3)
0.5~0.3	NVA	13 (28.9)	15 (33.3)	15 (33.3)	12 (26.7)
	BCVA	14 (31.1)	13 (28.9)	13 (28.9)	10 (22.2)
1.0~0.6	NVA	9 (20.0)	4 (8.9)	2 (4.4)	2 (4.4)
	BCVA	6 (13.3)	2 (4.4)	2 (4.4)	2 (4.4)

4.3. Recurrence of Anterior Uveitis After Surgery

Obvious anterior chamber reactions were found in 9 eyes after operation, of which 8 eyes had recurrence of uveitis. All of them underwent ocular B-ultrasound to rule out endophthalmitis. In 4 eyes, aqueous humor flashed significantly (++~+++). After treatment with 0.5% tropikamide and glucocorticoids etc, the inflammation gradually ameliorated to disappear, and the recovery time was 1 to 3 weeks. 2 eyes had an exudative membrane in the pupil area, which appeared on the first and the second day respectively after the operation. 0.5% tropikamide and tobramycin dexamethasone eye drops was given to mydriasis and anti-inflammtory treatments, and 0.3ml of

dexamethasone was injected under the conjunctiva, 1 time every day for 3 consecutive days, with local hot compress treatment as adjuvant therapy. After 4 to 5 days, the exudate membrane was partially absorbed. In 4 eyes, the local iris was dot adhesion, and the pupils appeared to be plum petals after dilation, but it did not affect vision. There were 2 patients who naturally maintained dilated pupils (>6mm) after the operation, and did not respond to miotics. The photophobia symptoms after the operation were obvious in the early period, and disappeared after 3 months after the operation. Another 2 cases had systemic symptoms such as joint pain and low-grade fever, but no obvious recurrence or aggravation of ocular inflammation, with consultation rheumatology and immunology treatment as auxiliary means.

Table 2. IOP levels at different time after surgery (mmHg).

	Before surgery	1day after surgery	1 week after surgery	1 month after surgery	3 months after surgery
	12.31±5.24	14.35±9.43	11.27±6.81	10.92±5.94	9.06±5.71
t		0.25	0.46	0.51	0.67
P		0.8	0.65	0.61	0.51

*Compared with preoperative intraocular pressure level

4.4. Intraocular Pressure After Surgery

The intraocular pressure was higher than normal in 3 eyes (6.7%) after operation, which were 28.9mmHg, 31.7mmHg and 32.3mmHg respectively. Among them, there was recurrence of uveitis in 2 eyes. On the first day after surgery, appropriate lateral incision was pressed to release aqueous humor according to the corneal condition, and avoided reflux caused by low intraocular pressure. The intraocular pressure was re-measured one hour later. According to the changes in intraocular pressure, pranoprofen and other non-steroidal anti-inflammatory drugs were prescribed, carteolol hydrochloride were given to reduce intraocular pressure. In 2 cases, the intraocular pressure returned to normal next day,

and the intraocular pressure decreased after stopping. In one case, brinzolamide timolol eye drops was used continuously for 3 days, and on the 4th day, the dose was reduced once a day before going to bed for 1 week, the intraocular pressure remained stable.

4.5. Cornea

Postoperative corneal edema was more obvious in 3 eyes (6.7%), of which 2 eyes had grade 4 nuclei. Intraoperative phacoemulsification energy was used more (CDE was 48.21 and 50.39, respectively). In 1 eye, the anterior chamber was shallow and increased the perfusion pressure, the deepening of the anterior chamber was still not obvious. Another 2 eyes had mild corneal edema. After 1 week of treatment, the

corneal edema gradually improved until it became transparent, and the corneal edema recovered completely in 1 to 2 weeks.

4.6. Fundus

6 eyes (13.3%) were found different degrees of macular atrophy (thickness of the nerve fiber layer in the macular area was less than 100 μ m), and the visual acuity after operation was still improved compared with that before operation. One eye developed macular edema 20 days after surgery and was treated with a retrobulbar injection of 20 mg of the triamcinolone acetonide. After 2 weeks, the edema subsided and the intraocular pressure was stable. There was no recurrence after 3 months follow-up.

4.7. Inflammation in the Contralateral Eye

No inflammation of the anterior segment of the contralateral eye was found after cataract surgery.

5. Discussion

Anterior uveitis is the most common type of uveitis, which could be divided into extrinsic, internal and secondary according to the cause of onset. Cataract is the most common complication of anterior uveitis. Clinically, opacity under posterior capsule is the main manifestation, which can gradually worsen and expand over time. The pathological mechanism of anterior uveitis complicated with cataract included the following aspects: 1. Uveal inflammation caused an increase in inflammatory factors in aqueous humor, changes in the physical and chemical properties of aqueous humor, and interfere with the normal metabolism of the lens; 2. Recurring attacks of uveitis lead to the iris adhesion to the lens, that is, iris posterior synechia. If it is not treated for a long time, it is easy to form pupil membrane closure, and then cataract [10]; 3. Long-term use of glucocorticoids due to uveitis can also cause cataracts to occur in advance. At present, with the continuous maturity of cataract phacoemulsification technology, its treatment of concurrent cataracts caused by uveitis become a commonly used surgical method [11]. However, phacoemulsification for cataract with posterior iris adhesion has its particularities before, during and after the operation. There are reports that intraoperative intravitreal injection of 3 mg triamcinolone acetonide (TA) is an effective and safe adjunctive therapy for preventing postoperative inflammation and complications [12]. It belongs to the category of complex cataract surgery, and its difficulty is higher than that of general cataract surgery.

Before surgery, 1. The medical history should be inquired in detail, whether the patients have a systemic autoimmune disease, such as rheumatism or rheumatoid arthritis, ankylosing spondylitis, etc. What about their systemic treatment, the use of drugs, and the latest attack. At the same time, whether there are patients with the same disease in the family, and what are the symptoms at the onset of the disease. 2. Before undergoing physical examination, we should

carefully understand the number of ocular uveitis episodes and the interval time, pay more attention to whether the ocular inflammation is in the active phase. It can be analyzed from the thickness and edema of the cornea, the number and shape of post-corneal deposits, and the flashing degree of aqueous humor. If the uveal inflammation is active, surgery should not be performed at once. It is necessary to wait for the inflammation control to be stable before considering surgery, so as to avoid further aggravation of inflammation caused by cataract surgery and irreversible damage to local tissues. 3. Check the preoperative visual acuity, intraocular pressure, corneal endothelial cell amount, evaluate the degree of lens opacity and lens nucleus hardness, and determine the difficulty of the operation properly. 4. To determine the extent of posterior iris adhesion, the surgeon should be aware of it and prepare the corresponding surgical instruments. For such patients, glucocorticoid eye drops should be used before surgery to reduce the contingent postoperative uveitis reaction. 5. Due to varying degrees and ranges of posterior iris adhesions and iris laxity, the pupils are often unable to be fully dilated, and many patients can't watch the fundus, and even OCT and other equipment cannot complete satisfactory examinations. The possibility of postoperative vision recovery need to be discussed and explained with the patients and their family members.

Therefore, this type of surgery has a certain degree of complexity and particularity, and it is best to ask an experienced surgeon to complete it. During the operation, energy use and tissue damage should be reduced as much as possible, and the occurrence of surgical complications should be prevented.

1. Cataract patients with posterior iris adhesion often have shallow anterior chambers and limited operating space. When making transparent corneal incisions, the knife should be inserted slowly and the direction should be parallel to the plane of the iris to avoid puncturing the iris or the anterior lens capsule. The length of the corneal tunnel is 2mm as the standard. Maintain the symmetry of the front and rear lips of the corneal incision to prevent the corneal incision from being too short. Otherwise, intractable iris prolapse may occur during the operation, causing iris depigmentation and damage.
2. After fully injecting the viscoelastic agent, we use Kuglen hook and phaco hook as a tool to perform a gentle and blunt two-handed separation of the adhered iris. The thick proliferative membrane should be cut off after peeling, and the anterior lens capsule membrane should be protected at the same time. If we pay enough attention to strength and direction during separation process, the anterior capsule is not easily damaged. When the anterior capsule cannot be completely preserved, the centrality and stability of the intraocular lens position should be considered when opening the window in the central part as much as possible, so as to create conditions for normal recovery after surgery. For those with very small pupils (diameter \leq 3mm), a pupil dilator or iris hook can be installed to facilitate

capsulorhexis. During the operation, the traction and damage to the iris and lens capsule can be reduced.

3. Posterior iris adhesion and the tension-free state after inflammation of the iris often result in the inability to fully dilate the pupils and the lack of red light reflection in the fundus. Therefore, it is best to maintain continuity during capsulorhexis and do it in one go. If continuous capsulorhexis cannot be completed, it may bring a lot of follow-up uncertainties, such as anterior capsule opening, posterior capsule rupture and nucleus sinking, etc.
4. When phacoemulsification of cataract nucleus, the position of the phacoemulsification needle should be at the iris plane to reduce corneal endothelial damage and rupture probability of posterior capsule, while preventing the phacoemulsification needle from aspirating the iris by mistake, causing iris damage or iris root breakage and bleeding, and may cause tension and agitation of the patient due to pain, which will affect the normal process of the operation.
5. The phacoemulsification needle should always be located in the center of the pupil, and the nucleus grasping, nucleating, splitting and emulsifying can be completed under direct visual conditions, which can increase the safety of the operation. In this group of patients, the iris is aspirated by the phacoemulsification needle in 2 eyes during the phacoemulsification process. One case may be related to the long-term use of drugs for treating prostate hypertrophy, belonging to iris floppy syndrome (IFS). As long as the operation is carefully performed, intraoperative iris damage and postoperative reactions can be reduced.
6. Avoid aspiration of the iris when aspirating the residual cortex, and fully polish the inner surface of the posterior capsule and the anterior capsule window to reduce the occurrence of postoperative cataracts. In view of the particularity of the cataract patients with uveitis, their condition should be closely observed in the postoperative review. The original basic disease plus the stimulation of cataract surgery, uveitis is more likely to recur. In uveitic cataract patients, a 60–90-day period of quiescence prior to cataract surgery has been strongly recommended, 30 days at least [13, 14]. These eyes with active inflammation or inflammation within 30 days are at significantly higher risk (estimated to be sixfold greater odds) for postoperative rebound inflammation. When uveitic quiescence period is less than 3 months preoperatively, there will have a 43.1% recurrence rate, versus cases quiet for more than 3 months, a 20.7% recurrence rate. [15]

The occurrence of this kind of uveitis might be related to the original uveitis, and it may be recurrent. For recurring eyes, treatment should be promptly and actively treated: mydriasis, corticosteroids, non-steroidal anti-inflammatory drugs, etc., local hot compresses, and systemic glucocorticoids when necessary. In this group of patients, uveitis occurred in 8 eyes, and all recovered satisfactory vision after treatment. Among them, 2 cases developed joint pain and low-grade fever, but

there was no obvious recurrence or aggravation of ocular inflammation.

In uveitis, because iris exudates and pigments blocked the trabecular meshwork through the aqueous circulation, the intraocular pressure rise after the operation, and the intraocular pressure should be controlled in time to avoid secondary glaucoma. Uveitis is one of the most serious causes of glaucoma, especially anterior uveitis [16]. The incidence of secondary glaucoma caused by uveitis (uveitic glaucoma) is reported to be 10–20% [3].

The nucleus of some cataracts is relatively hard and the anterior chamber is shallow during the operation, so it is prone to postoperative corneal edema and Descemet's membrane folds. This is the reason for the poor early postoperative vision. With the gradual improvement of the corneal condition, the vision could become better.

6. Conclusion

The anterior uveitis is the most common initiation factor of complicated cataract, which is long-lasting and recurrent inflammation. The high-risk factors for complicated cataract surgery including ectopic iris adhesion, iris floppy syndrome (IFS), small pupil, abnormal suspensory ligament, etc. Compared to common cataract surgery, this surgery become more difficult and uncertain. At the same time, with the continuous improvement of the functions of cataract surgery equipment and the increasing skill of surgical techniques, complicated cataracts can also be successfully operated and achieved relatively good clinical results. Surgery-related postoperative inflammation is another main feature of this type of surgery, which requires more clinical observation and timely treatment. Otherwise, it is not uncommon for occlusion of pupil, close adhesion between iris and intraocular lens, angle-closure glaucoma, etc., which require a second operation or even multiple operations.

In summary, as long as the preoperative preparations are carefully arranged, meticulous phacoemulsification surgery for cataracts, and strict observation of the condition after the operation, cataracts with old anterior uveitis and posterior iris adhesions, phacoemulsification is relatively safe and reliable, and good eyesight can still be obtained after surgery, and both doctors and patients are relatively satisfied with the results.

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