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Effect of quadrant mechanical pupillary dilatation of Chop hooks during surgery of uveitis complicated cataract

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引用:陈子扬,曹俊昌,叶照达,等. 葡萄膜炎并发白内障术中使用 Chop 钩象限性机械扩张瞳孔的效果. 国际眼科杂志 2022;22(12):1943-1947

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Received: 2021-07-01 Accepted: 2022-10-08

葡萄膜炎并发白内障术中使用 Chop 钩象限性机械扩张瞳孔的效果

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摘要

目的:报道在葡萄膜炎并发白内障患者的白内障手术中使用一种特殊的 Chop 钩象限性机械扩张瞳孔的手术效果。

方法:单手术、回顾性、非比较病例报道。纳入在白内障术中接受 Chop 钩象限性机械扩张瞳孔特殊技术治疗的葡萄膜炎并发白内障患者。

结果:共 14 例葡萄膜炎并发白内障患者 16 眼,男性 5 例,女性 9 例,平均年龄 58.0±13.8(29~79)岁,在白内障手术中接受 Chop 钩象限性机械扩张瞳孔治疗。采用象限性机械瞳孔扩张后,扩张瞳孔直径为 5.81±0.46(5.0~6.5)mm,并可保持至手术结束。术后,瞳孔居中,约为圆形,瞳孔直径为 3.0~4.0mm。在某些情况下,在虹膜和瞳孔的边缘观察到小切迹,但患者没有出现眩光不适,直接和间接的光反射大致正常。散瞳孔治疗后,瞳孔变圆,与人工晶状体无粘连,术后最佳矫正视力(BCVA)明显优于术前($P<0.01$)。术中及术后随访期间未观察到严重的并发症,如悬韧带断裂、囊膜边缘破裂、前房积血、前葡萄膜炎复发、角膜水肿、眼压升高(IOP>21mmHg)、虹膜撕裂、虹膜异常、后粘连。

结论:该象限机械瞳孔扩张技术对于葡萄膜炎并发白内障患者是一种简单有效的白内障手术方法,且并发症发生率低。

关键词:瞳孔;扩张;葡萄膜炎;并发性白内障

Abstract

• AIM: To report the surgical effects of using a special Chop hooks technique to dilate the pupils during cataract surgery of patients with uveitis complicated cataract.

• METHODS: A single-surgeon, retrospective, non-comparative case report. All patients with uveitis complicated cataract who were treated with quadrant mechanical pupillary dilatation of Chop hooks were included.

• RESULTS: A total of 16 eyes of 14 patients (with 5 males, 9 females and a mean age of 58.0±13.8 years old; range: 29-79 years old) underwent mechanical pupillary dilatation of Chop hooks during cataract surgery. After using quadrant mechanical pupillary dilatation, the dilated pupil diameter was 5.81±0.46 (range: 5.0-6.5) mm, and the size was maintained until the end of the operation. After the operation, the pupils were centered and approximately round, and the diameter of the pupils was 3.0-4.0 mm. In some cases, small notches were observed at the edge of the iris and pupil. However, the patients had no complaints of glare. Direct and indirect light reflections were roughly normal. After mydriasis treatment, the pupils became round and did not adhere to the intraocular lens, and the postoperative best-corrected visual acuity (BCVA) was significantly better than that before surgery ($P<0.01$). No serious intraoperative or postoperative complications, including zonular fiber rupture, capsular rim rupture, hyphema, anterior uveitis, corneal edema, raised intraocular pressure (IOP > 21 mmHg), iris tearing, iris abnormalities and posterior synechiae, were observed during the follow-up period.

• CONCLUSION: With low incidence of complication, the technique of quadrant mechanical pupillary dilatation is a simple and effective procedure for cataract surgery in patients with uveitis complicated cataract.

• KEYWORDS: pupil; dilatation; uveitis; complicated cataract

DOI:10.3980/j.issn.1672-5123.2022.12.02

Citation: Chen ZY, Cao JC, Ye ZD, *et al*. Effect of quadrant mechanical pupillary dilatation of Chop hooks during surgery of uveitis complicated cataract. *Guoji Yanke Zazhi* (*Int Eye Sci*) 2022; 22(12):1943-1947

INTRODUCTION

In uveitis, inflammatory cells are deposited in the capsule of the lens and they affect the capsule's permeability. In addition, long-term local or oral corticosteroids increase the permeability to cations, resulting in changes in the protein structure to form insoluble proteins[1]. This decreases the transparency of the lens, and the condition is known as cataract. According to reports, the incidence of cataracts complicated by uveitis is as high as 50%-70%[2]. In patients with uveitis after cataract development, the visual acuity decreases significantly, seriously affecting the patients' daily life. It is well known that mydriasis is needed before conventional cataract surgery to facilitate the tear of the anterior capsule, phacoemulsification of the turbid lens, and implantation of an artificial lens. However, in uveitis cases, due to pupil - iris adhesions resulting from repeated inflammation of the iris, mydriatics cannot dilate the pupil very well, which makes cataract surgery more difficult[3]. Recently, scholars at home and abroad have been thinking about improving surgical techniques for the treatment of cataracts in patients with uveitis. For example, the methods of dilating the pupil include ring-like cutting of the pupil edge, viscoelastic injection to separate adhesions, and mechanical dilation (using an iris retractor or lens positioning hook to push and pull the iris)[4-6]. In recent years, our department has found that chop hooks can be used to dilate pupils to a certain size to facilitate further surgery. The concrete content is reported as follows.

METHODS

This study was conducted in accordance with the Declaration of Helsinki and was approved by the ethics committee of the Second Affiliated Hospital of Fujian University of Traditional Chinese Medicine, Fujian, China. This was a retrospective interventional case series of all patients with cataracts complicated by uveitis who underwent cataract surgery between July 2018 and January 2020 by a single surgeon in the Second Affiliated Hospital of Fujian University of Traditional Chinese Medicine. This series included patients with uveitis complicated cataract, with or without keratic precipitates (KP), with no active inflammation lasting for more than 3mo, that were Tyn (-), and had a corneal endothelial cell count more than 1600/mm^2. The exclusion criteria were as follows: pregnant women; patients already enrolled in other clinical studies, other ocular surgeries at the same time or before; previous use of contact lenses; patients with other severe ocular diseases, systemic diseases (including diabetes or hypertension); patients who declined to consent.

All patients underwent a complete ophthalmological examination of 1d, 1wk and 1mo before and after the operation, which included the examination of the anterior chamber, pupil size, iris adhesion, light reaction, and lens opacity using a slit lamp, as well as the best corrected visual acuity (BCVA), intraocular pressure (IOP), *etc*. Patients with small pupil sizes (≤5.0 mm) that were unable to be dilated after the administration of mydriatics were referred to surgery for the method introduced as follows.

Surgical Technique

Preoperative preparation Preoperative lacrimal sac regurgitation tests are advised as routine procedures. Prophylactic broad-spectrum antibiotics like tobramycin eyedrops and topical nonsteroidal anti-inflammatory drugs (NSAIDs), like flurbiprofen or diclofenac sodium drops, were used 3 to 4 times a day for 1d prior to surgery. The eye to be operated on must be marked. Tropicamide every 30min for 2h before the surgery to obtain adequate and sustained pupillary dilatation intraoperatively.

Surgical procedure Surface anesthesia was obtained by topical administration of proparacaine hydrochloride eye drops (Alcaine) 3-4 times. After surface anesthesia, the skin of the eyelids and that around the eye was again cleaned with 10% povidone-iodine solution. A side-port entry was made for filling the anterior chamber with a viscoelastic substance. A 3-3.5 mm incision in the 1-3 o'clock clear cornea with a diamond keratome or a scleral tunnel incision with an internal corneal lip was made. Two chop hooks (Figure 1) were then used to dilate the pupils in the order of: horizontal dilatation, vertical dilatation, and quadrant dilatation in the anticlockwise direction (6:00-3:00-12:00-9:00; Figure 2). Continuous curvilinear anterior capsulotomy was then performed using a bent 4.5-gauge needle, followed by hydrodissection. The irrigating solution was slowly injected in different quadrants underneath the edge of the anterior capsule to separate the cortex and nucleus from the posterior capsule. Nuclear emulsification was done by the ultrasonic power of a phaco handpiece. Thereafter, the nucleus was divided into small pieces with the help of a chopper and phaco tip. The remaining lens cortex was aspirated with the help of a coaxial or bimanual irrigation-aspiration cannula. A posterior chamber foldable lens can then be implanted without enlarging the corneal incision as it is meant to be a watertight incision after the surgery.

Postoperative management An aggressive course of topical corticosteroids should be administered to reduce the inflammatory reaction after surgery. Topical corticosteroid (tobramycin dexamethasone, 15mg∶5mg, 5mL) eye drops are used four times a day for 2wk. After 2wk, fluorometholone eye drops are used four times a day for 2wk, and tropicamide eye drops are used once daily to regulate the pupil.

Statistical Analysis All data was statistical analyzed in SPSS. The BCVA data was analyzed by Friedman test, and other data are mainly statistical description.

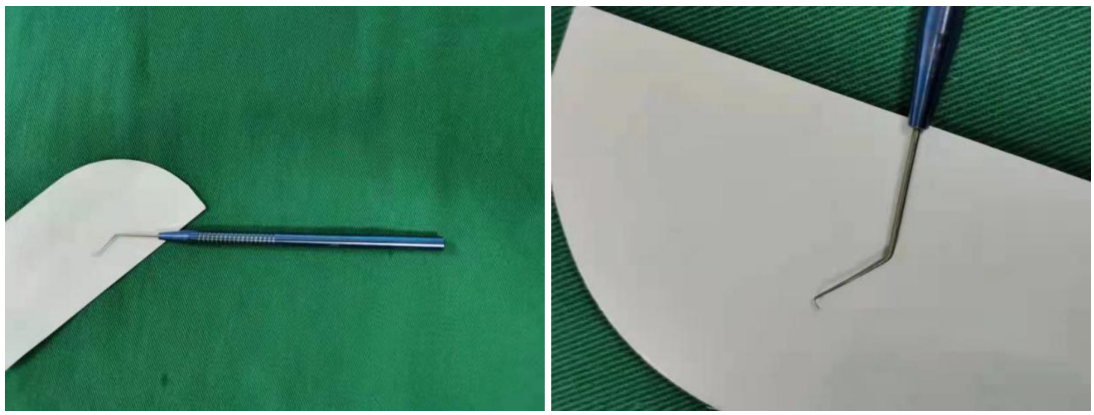

Figure 1 The tool was used to dilate the pupils, which was named as chop hook.

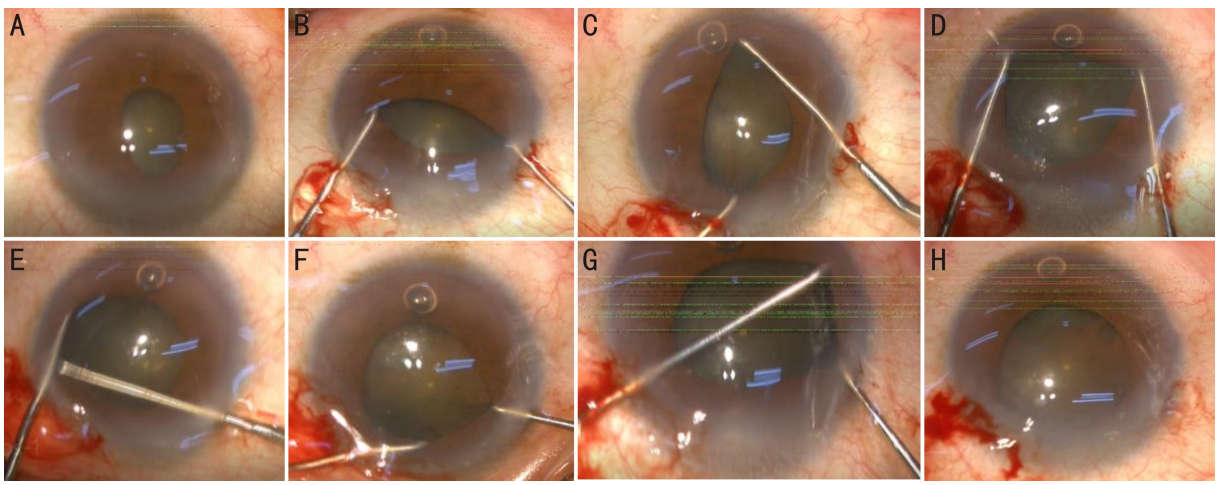

Figure 2 The surgical steps in dilating pupil in a 79-year-old man. A: After mydriasis, the pupil of the patient was pear-shaped, with a diameter of about 3.6 mm, part of posterior iris adhesion; B-G: Mild irritate irises and quadrant push-pull dilate pupil; H: After dilation, the pupil is roughly round, about 6.5 mm in diameter.

RESULTS

A total of 16 eyes of 14 patients (5 males and 9 females) were included in this study. The mean age was 58.0±13.8 (29-79) years old. There were 4 eyes included in this study had KP, with different degrees of posterior iris adhesion (no anterior iris adhesion) in all eyes. After using tropicamide eye drops, the pupils were not regularly round, and the pupil diameter was 2.94±0.56 (2.0-4.0) mm. During surgery, the dilated pupil diameter was 5.81±0.46 (5.0-6.5) mm, and the size was maintained until the end of the operation. After the surgery, there were iris notches found near the pupillary margin in some cases (Figure 2). On the first postoperative day, the pupil was centered and approximately round. The diameter of the pupil was 3.31±0.39 (3.0-4.0) mm. In some cases, small notches were observed at the edge of the iris. However, the patients had no complaints of glare. The pupil diameter was 3.50±0.35 (3.0-4.0) mm under natural light 1wk after the operation, and the direct and indirect light reflections were roughly normal. After treatment with mydriatics, the pupils became round and did not adhere to the artificial lens. The pupil diameter remained at 3.38±0.38 (3.0-4.0) mm at 1mo after the operation.

The BCVA postoperatively was significantly better than that before operation (P<0.01). (Table 1)

Table 1 Best-corrected visual acuity before and after treatment

Time	BCVA (LogMAR)			
	>1.0	1.0-0.5	0.5-0.3	0.3-0.0
Preoperative	10	3	3	0
Postoperate-1d	2	3	1	10
Postoperate-1wk	0	3	2	11
Postoperate-1mo	0	2	3	11

BCVA: Best-corrected visual acuity.

No serious intraoperative or postoperative complications, including zonular fiber dialysis, capsular rim rupture, hyphema, anterior uveitis, corneal edema, raised IOP (>21 mmHg), iris tearing, iris abnormalities, posterior synechiae and macular edema, were observed during the follow-up period. The integrity of the iris, which was assessed by slit-lamp examination, remained intact and returned to a relative physiologic size without iridodialysis or serious distortion. Some patients had some iris notches, but they did not complain of glare or other forms of discomfort.

DISCUSSION

Posterior synechia of the iris in uveitis causes cataracts and complicates cataract surgery. It is associated with some challenges with regard to ensuring the right time of the surgery,

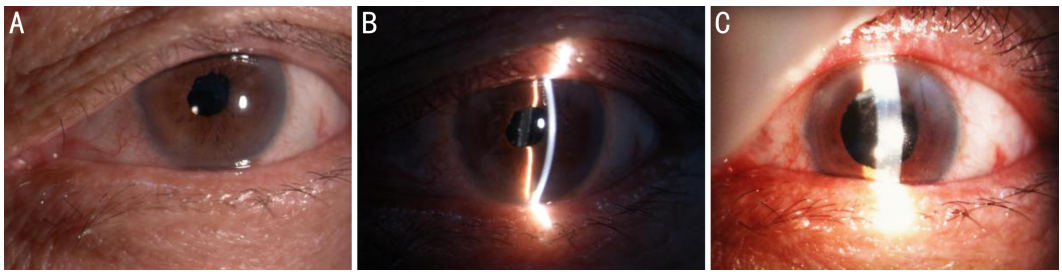

Figure 3 The anterior segment under slit lamp photography in a 79-year-old man at 1wk after operation. A: Under diffuse illumination, the surface was observed; B: Under direct focal illumination, pupil diameter is about 3.5 mm, cornea is transparent, and artificial lens is transparent and center; C: After mydriasis treatment, the pupil was round and not adhere to the artificial lens. Its diameter was about 6 mm.

the right perioperative medications, methods of pupil dilation, and prevention of possible complications after surgery[7].

In the past, removal of the iris root and the adherent part or radial incision of the iris was advocated. Sometimes, the iris dilator was inserted from the excision part[8-9]. Subsequently, some scholars cut the pupil edge in a ringlike fashion to dilate the pupil. This operation requires that the width of the ring should not exceed 1 mm to prevent damage to the pupil sphincter[4]. However, such methods are complicated, and the visual quality may be affected by the size of the pupil. In recent years, some scholars have used viscoelastic injection to separate adhesions and mechanically dilate the pupil (such as the use of an iris retractor or a lens positioning hook to push and pull the iris on both sides), which shortens the operation time and decreases unnecessary damage to the iris to some extent[5-6]. In this study, posterior synechia of the iris was separated by a viscoelastic agent, and the iris was then slightly stimulated by a chop hook (cataract split) in quadrants to dilate the pupil. Compared with the previous horizontal-vertical push-pull method, the quadrant operation can balance the force of each part of the iris and reduce the risk of iris tearing and pupil sphincter injury. After the operation, the pupils of all the patients were centered, their shapes were roughly round, and iris occasionally existed iris incisors. The diameter of the pupil was about 3.0-4.0 mm in natural light, and light reflection was normal. This shows that the effect of quadrant manual dilatation on the pupil sphincter is small. The visual acuity of the patients postoperatively was higher than what it was preoperatively. Although some patients had some iris notches, they did not complain of glare or other forms of discomfort.

Most scholars advocate that cataract surgery should be performed after controlling the uveitis for a minimum of 2-3mo[10]. Otherwise, the surgery will lead to the recurrence of the uveitis. The patients included in this study had no active inflammation for more than 3mo, regardless of existing KP (4 eyes). All patients had negative Tyn signs; However, surgical treatment can also lead to postoperative inflammatory reactions, especially within 2-3wk after surgery, and severe cases cause the recurrence of uveitis[11]. Therefore, this emphasizes the importance of perioperative drugs in reducing postoperative reactions[12]. All patients were treated with tobramycin eye drops and diclofenac sodium eye drops (non-steroidal anti-inflammatory drugs) before the operation. Postoperatively, the patients were added corticosteroid drops. There was no recurrence of uveitis in all the patients within 1mo after the operation. Before and after the operation, tropicamide eye drops were used. Before the operation, the patients' pupils could not be dilated because of posterior iris adhesion. However, tropicamide eye drops paralyzed the pupil sphincter to a certain extent and reduced the risk of intraoperative injury. Within 1mo after the operation, the eye drops were used to dilate the pupils before bedtime. The pupils were roughly round at 1wk after the operation, and no iris or artificial lens adhesion occurred.

The probability of high IOP after cataract surgery in patients with uveitis is high. The risk factors include retention of the viscoelastic agent, loss of the iris pigment during the operation, and recurrence of inflammation postoperatively[13]. None of the patients had high IOP, iris pigment shedding, or inflammatory recrudescence after surgery, indicating that this technique has little effect on the iris.

In conclusion, this study demonstrated that the quadrant mechanical pupillary dilatation technique is a simple and effective procedure for cataract surgery in uveitis and is associated with low recurrence and complication rates. The limitations of this study stem from its small sample size, retrospective design, and the lack of a control group for comparison, but this series, which is based on the experience of a single surgeon and had a postoperative follow-up period, may be an important contribution to the surgical techniques for dilating small pupils.

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