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Key Points of Clinical Nursing on Postoperative Recovery in Ultrasound Cycloplasty for Glaucoma Treatment

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Abstract

Background: Glaucoma is a leading cause of irreversible blindness worldwide, characterized by progressive optic nerve damage and visual field loss, often associated with elevated intraocular pressure (IOP). Traditional treatment options include medications and surgical interventions; however, many patients experience refractory glaucoma that does not respond adequately to standard therapies. Ultrasound cycloplasty has emerged as a promising alternative for managing refractory glaucoma by reducing IOP through targeted tissue ablation. Due to the limited relevant research on the perioperative nursing of UCP, this study explores the key nursing points during the perioperative period of ultrasound cycloplasty. **Methods:** A retrospective analysis was conducted on the clinical data of 53 glaucoma patients, including preoperative and postoperative intraocular pressure (IOP) changes, use of antiglaucoma medications, and ocular pain scores. Preoperative nursing includes medical history assessment, surgical explanation, and ocular examination. Postoperatively, IOP monitoring and medication guidance were provided. **Results:** Postoperative IOP was significantly reduced, the number of antiglaucoma medications used decreased, and ocular pain scores were notably lower. At three months postoperatively, 96.23% of patients exhibited a decrease in IOP. Ultrasound Cycloplasty effectively lowered IOP, alleviated ocular pain, and reduced the use of antiglaucoma medications in patients with various types of glaucoma. **Conclusion:** Ultrasound Cycloplasty is a safe and effective minimally invasive procedure for treating glaucoma. Proper clinical nursing plays a crucial role in the

success of the surgery and the patient's recovery, including preoperative communication and education, intraoperative monitoring and technical proficiency, as well as postoperative IOP monitoring and care. Long-term IOP monitoring and regular nursing assessments are recommended for patients undergoing this procedure to ensure the durability and safety of the treatment outcomes.

Keywords

Ultrasound Cycloplasty, Glaucoma, Nursing, Intraocular Pressure, Pain

1. Introduction

Glaucoma is the second leading cause of blindness worldwide, following cataracts. It is also the leading cause of irreversible blindness globally [1], severely affecting patients' vision and quality of life [2]-[4]. Glaucoma typically causes characteristic visual field defects and may eventually lead to total blindness. It is estimated that by 2040, the number of glaucoma patients will increase from the current 76 million to 112 million [1]. Although multiple genetic and environmental factors associated with the onset and progression of glaucoma have been identified, the only modifiable risk factor confirmed to date is intraocular pressure (IOP) [5]. Clinically, IOP is reduced through methods that either decrease aqueous humor production or increase its outflow, including pharmacological treatments, laser therapies, and surgical interventions [6]. Therefore, identifying safe and effective treatment options remains crucial.

In recent years, Ultrasound Cycloplasty has made significant advances in the field of glaucoma treatment [7]. It has become a widely applicable and highly safe therapeutic method [8]. Compared to traditional glaucoma surgery, this technique is precise and incision-free, with good patient tolerance. By accurately targeting the ciliary body, this technique selectively applies thermal effects to the ciliary body while protecting adjacent tissues [9], making the treatment process simple, convenient, and time-saving, effectively reducing IOP [10]. However, there is still limited clinical research and reports on nursing care associated with ultrasound Cycloplasty. This study aims to explore the perioperative nursing key points by observing the changes in IOP and subjective pain perception both pre- and postoperatively, thereby providing a more solid scientific basis for future clinical nursing care.

2. Materials and Methods

2.1. Patient Collection and General Information

This study was a retrospective analysis conducted from March 2023 to March 2024, including 53 patients (53 eyes) who underwent Ultrasound Cycloplasty treatment at our institution. Among the participants, 23 were male and 30 were

female; the ages ranged from 16 to 89 years, with a mean age of 58.83 ± 16.31 years. The inclusion criteria were as follows: patients who met the indications for ultrasound Cycloplasty, had ineffective ocular pressure control with medication, were able to understand and complete the Numerical Rating Scale (NRS) pain assessment, and were willing to cooperate with the evaluation and sign the informed consent form. The exclusion criteria were: 1) a history of ocular trauma; 2) coexisting ocular conditions such as conjunctivitis, keratitis, corneal opacities, lens dislocation, retinal and optic nerve diseases, etc.; 3) severe systemic diseases affecting the heart, liver, kidneys, or blood, or mental disorders that hindered the ability to comply with the surgery; 4) patients with poor adherence to surgery or examination.

The study was conducted following the principles of the Declaration of Helsinki, and the research protocol was approved by the Medical Ethics Committee, with approval number XMYKZX-LW-2024-013.

All categorical and continuous data were processed using SPSS 26.0 and Prism 9.0 statistical software. Continuous variables are presented as mean ± standard deviation (mean ± SD). Since multiple groups of data were compared for each observation index, Welch's ANOVA test was used for statistical analysis. For certain two-group comparisons of continuous data, traditional ANOVA tests were applied [11]. Some categorical data are expressed as percentages (%). A P-value of <0.05 was considered statistically significant. The basic characteristics of the patients are shown in **Table 1**.

Table 1. Baseline of 53 patients.

Age (Years, mean ± SD)	Gender (n, %)		Eye Side (n, %)		Types of Glaucoma (n, %)			UCP model (n, %)			number of sectors (mean ± SD)
	Male	Female	Right	Left	PACG	POAG	SG	#11	#12	#13	
58.83 ± 16.31	23 (43.40%)	30 (56.60%)	29 (54.72)	24 (45.28%)	26 (49.06%)	4 (7.55%)	23 (43.40%)	8 (15.09%)	31 (58.49%)	14 (26.42%)	9.40 ± 1.26

PACG-Primary Angle-Closure Glaucoma; POCG-primary open-angle glaucoma; SG-Secondary Glaucoma, UCP-Ultrasound Cycloplasty.

2.2. Preoperative Nursing

Thoroughly inquire about the patient's medical history and evaluate the patient's overall physical, psychological, and ocular surface conditions to serve as the basis for formulating an individualized nursing plan for each patient. Use plain language to introduce the principle, operation method, and surgical safety of ultrasound cycloplasty to relieve the patient's anxiety. Assist the doctor in completing the admission eye examinations, administer medications to the patient as prescribed, monitor the daily intraocular pressure, and guide the patient to complete examinations such as gonioscopy, computerized visual field testing, optical coherence tomography (OCT), ultrasound biomicroscopy (UBM), and ocular B-ultrasound [12].

To reduce the risk of postoperative infection, it is recommended to start using antibiotic eye drops locally three days before surgery for preventive purposes [13]. One day before the operation, trim the eyelashes to facilitate the surgical procedure

and further reduce the infection probability. Meanwhile, perform routine lacrimal duct irrigation before the operation to check for any abnormal secretions. On the day of the operation, irrigate the conjunctival sac again and cover the eye with sterile gauze. If the patient has chronic dacryocystitis, consider canceling the operation. For patients with severe preoperative eye pain, intravenous infusion of mannitol can be used 4 to 6 hours before the operation to reduce the intraocular pressure and analgesic drugs can be administered concomitantly to relieve the pain [14], ensuring the patient's cooperation during the operation. Check the instruments, power supply, and appropriate ultrasonic probes to be used on the day before the operation.

After the patient enters the operating room, briefly explain the surgical process to the patient, emphasizing intraoperative cooperation, and train the patient on eye position, head position, and body position. Instruct the patient to inform the medical staff verbally if they have an uncontrollable cough or sneeze and need to pause the operation. During the ultrasound cycloplasty operation, the machine will emit a beeping sound. Inform the patient not to be nervous. Inform the patient that the operation will take approximately 10 minutes to enhance the patient's understanding, eliminate unstable emotions, and inform the patient in advance that pain may occur during the ultrasonic ablation area. Generally, the pain will be significantly relieved after the operation to further alleviate the patient's preoperative anxiety and increase the patient's pain threshold [15].

2.3. Intraoperative Nursing

During the surgical process, closely monitor the patient's respiration, pulse, and blood pressure changes. Especially when performing retrobulbar nerve block anesthesia, pay attention to the possible bradycardia and blood pressure elevation caused by the oculocardiac reflex [16] [17]. During the treatment, the patient needs to be in the supine position. Place the positioning ring on the affected eye and ensure its close contact with the eyeball through a low-level negative pressure. To maintain the stability of the negative pressure, the doctor needs to manually fix the positioning ring. After the eyeball is fixed, insert the treatment probe into the positioning ring. This operation creates a cavity of approximately 4 milliliters. Throughout the process, the assistant and nurse should continuously add normal saline to maintain the water filling of the cavity. At the same time, remind the patient to notify the medical staff in time if they feel eye pain or need to cough or sneeze, and avoid turning the head or closing the eyes forcefully to prevent the negative pressure suction ring from falling off, which may lead to the interruption of the operation or damage to the normal ocular tissues. The contralateral eye should also be properly covered to ensure the patient's safety and the smooth progress of the operation.

2.4. Postoperative Nursing

During the postoperative period, closely observe whether the patient has conjunctival

congestion and check the visual acuity recovery. Measure the intraocular pressure twice a day using a non-contact tonometer and a rebound tonometer respectively and take the average of the measurements of the two instruments. At the same time, inquire whether the patient has symptoms such as eye swelling and pain, headache, nausea, or vomiting, which may indicate increased intraocular pressure, and record the pain intensity using the NRS score. Postoperative nursing includes requiring the patient to stay in bed and rest quietly on the day of surgery. After the first day, the patient can resume a normal diet. Recommend easily digestible foods rich in crude fiber to maintain smooth bowel movements. Avoid long periods of bowing the head or bending over, choose a relatively loose collar, avoid drinking a large amount of water at one time, and avoid straining during defecation. The discharge health guidance should emphasize the following points: 1) Ensure sufficient rest, avoid overexertion, pay attention to eye hygiene, and avoid touching the eyes directly with hands to prevent infection. 2) Have a reasonable diet to enhance physical fitness, eat more fruits and vegetables, reduce the intake of spicy and fried foods, and maintain smooth bowel movements. 3) Continue to use anti-inflammatory drugs such as prednisone and antibiotics after surgery to prevent infection. At the same time, use atropine gel to paralyze the ciliary muscle, maintain the preoperative intraocular pressure-lowering drugs, adjust the medication according to the postoperative reexamination results, and strictly follow the doctor's instructions without discontinuing the medication without permission [18]. The patient should have regular intraocular pressure reexaminations at 1 week, 1 month, and 3 months after discharge.

3. Results

Both the intraocular pressure changes and the NRS score as well as the number of local medications showed significant improvements after the operation. See **Table 2** for details.

Table 2. Intraocular pressure, NRS score, and the number of intraocular pressure-lowering medications in patients before and after surgery at different periods.

Index Time	Preoperation	1 day after surgery	1 week after surgery	1 month after surgery*	3 months after surgery*	P
IOP (mmHg, mean ± SD)	43.05 ± 11.07	23.16 ± 8.17	18.00 ± 7.22	18.97 ± 6.65	21.71 ± 8.61	<0.05
NRS (mean ± SD)	4.91 ± 1.47	0.34 ± 0.76	0.17 ± 0.47	0.16 ± 0.37	0.32 ± 0.72	<0.05
Types of local medications (mean ± SD)	3.38 ± 0.74	2.32 ± 1.48	1.74 ± 1.36	1.52 ± 1.36	1.41 ± 1.44	<0.05

IOP-Intraocular Pressure; NRS-Numerical Rating Scale pain assessment. *22 patients were lost to follow-up at one month after the operation and 31 patients were lost to follow-up at three months after the operation.

3.1. Changes in Intraocular Pressure before and after Surgery at Different Periods

The intraocular pressure of 53 cases (53 eyes) before surgery was 43.05 ± 11.07

mmHg. The intraocular pressure on the first day after surgery was 23.16 ± 8.17 mmHg, and the intraocular pressure at one week after surgery was 18.00 ± 7.22 mmHg. There was approximately a loss to follow-up situation one month after surgery. Finally, the intraocular pressure of 31 cases (31 eyes) was 18.97 ± 6.65 mmHg, and the intraocular pressure of 22 cases (22 eyes) at three months after surgery was 21.71 ± 8.61 mmHg. The intraocular pressure during the postoperative follow-up was statistically different from that before surgery ($P < 0.05$). Although the intraocular pressure at three months after surgery was higher than that at one month after surgery, it was found by the traditional ANOVA test that there was no statistical difference in intraocular pressure between three months and one month after surgery ($P = 0.219$). See Figure 1 for details.

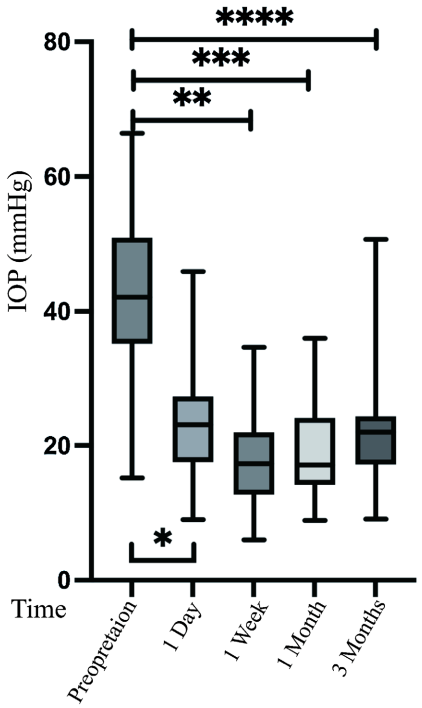

Figure 1. Intraocular pressure in patients before and after surgery at different time points. It can be observed that the intraocular pressure at any postoperative time point is significantly lower than that before surgery.

3.2. Changes in Visual Acuity before and after Surgery

Based on the visual acuity at the last reexamination, 31 cases (31 eyes) of patients had improved visual acuity, accounting for 58.49%. 18 cases (18 eyes) of patients had unchanged visual acuity, accounting for 33.96%, and 4 cases (4 eyes) of patients had continued visual acuity decline, accounting for 7.55%.

3.3. Changes in Pain before and after Surgery at Different Periods

In this study, the NRS score was used as the pain evaluation standard for patients at different periods. The NRS score of 53 cases (53 eyes) before surgery was 4.91 ± 1.47. The NRS score on the first day after surgery was 0.34 ± 0.76, and the NRS

score one week after surgery was 0.17 ± 0.47. There was approximately a loss to follow-up situation one month after surgery. Finally, the NRS score of 31 cases (31 eyes) was 0.16 ± 0.37, and the NRS score of 22 cases (22 eyes) three months after surgery was 0.32 ± 0.72, which was higher than that one month after surgery, similar to the situation of intraocular pressure. The intraocular pressure during the postoperative follow-up was statistically different from that before surgery ($P < 0.05$). For the above situation, the traditional ANOVA test was also performed on the NRS scores of one month and three months after surgery, and it was found that there was also no statistical difference ($P = 0.3547$). See Figure 2 for details.

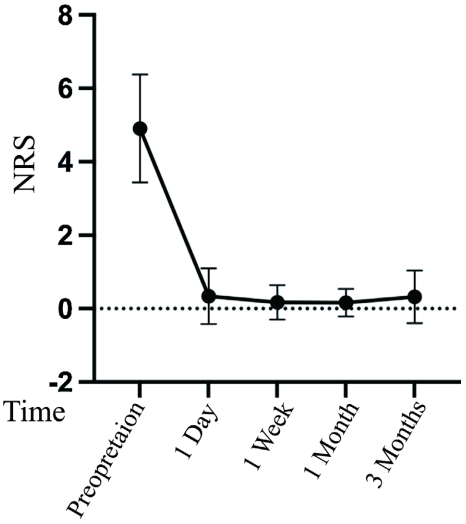

Figure 2. Pain in patients before and after surgery at different time points. The line graph shows that starting from the first day after surgery, the reported pain levels were significantly lower, and this trend was consistently maintained through three months postoperatively.

3.4. Types of Local Medications before and after Surgery at Different Periods

The types of eye medications for 53 cases (53 eyes) before surgery were 3.38 ± 0.74. The type of eye medications on the first day after surgery was 2.32 ± 1.48, and the type of eye medications one week after surgery was 1.74 ± 1.36. The types of eye medications in 31 cases (31 eyes) at one month after surgery was 1.52 ± 1.36, and the types of eye medications in 22 cases (22 eyes) at three months after surgery was 1.41 ± 1.44. The types of eye medications during the postoperative follow-up were statistically different from those before surgery ($P < 0.05$). See Figure 3 for details.

4. Discussion

Glaucoma is a significant global health issue, ranking as the second leading cause of blindness worldwide and the foremost cause of irreversible blindness. Over the years, numerous studies have been dedicated to exploring the treatment of glaucoma, with UCP emerging as a promising therapeutic approach. However, upon

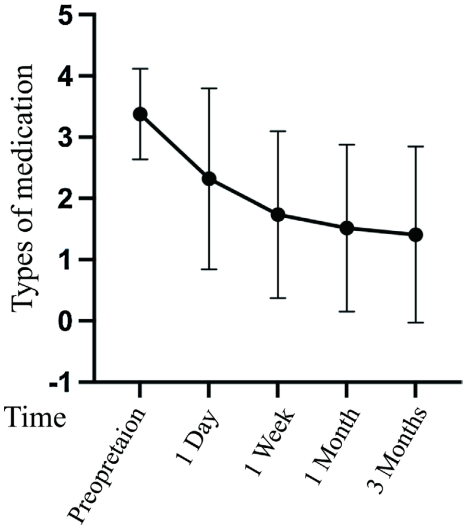

Figure 3. Types of medication used in patients' eyes at different time points before and after surgery. The use of local glaucoma medications showed a gradual decrease over the three-month postoperative follow-up period.

conducting a comprehensive search on PubMed, it has been surprisingly found that there is a paucity of research specifically focusing on the key points of nursing care associated with the UCP procedure. And our Boolean logic search strategy is formulated as follows: ("Ultrasound Cycloplasty" [Title/Abstract] OR "UCP" [Title/Abstract]) AND ("Glaucoma" [Title/Abstract]) AND ("Nursing" [Title/Abstract] OR "Intraocular Pressure" [Title/Abstract] OR "Pain Management" [Title/Abstract] OR "Preoperative Care" [Title/Abstract] OR "Intraoperative Care" [Title/Abstract] OR "Postoperative Care" [Title/Abstract]).

Given this research gap, our center was motivated to conduct this study. We aimed to document and analyze our perioperative nursing practices and procedures systematically. By closely monitoring and evaluating various patient parameters such as IOP, medication usage, and pain levels, we endeavored to distill the essential nursing care points during the perioperative period of UCP. This study not only fills a void in the current literature but also holds the potential to provide valuable clinical guidance for optimizing patient care and improving the overall outcomes of UCP treatment for glaucoma patients.

Based on the research results, it was found that after ultrasound cycloplasty, the intraocular pressure of patients was significantly reduced, the number of anti-glaucoma medications decreased, and the eye pain score was markedly decreased. Follow-up to 3 months after the operation, based on the final intraocular pressure results, 51 cases (96.23%) of patients had a reduction in intraocular pressure compared with that before the operation. This indicates that under good clinical nursing, ultrasound cycloplasty can significantly reduce intraocular pressure, relieve eye pain, and reduce the number of anti-glaucoma medications used in the treatment of various types of glaucoma. Especially in terms of pain relief, it seems to achieve remarkable results, which is similar to the results of several previous international studies [19]-[22]. This also significantly reduces the postoperative

nursing pressure. At the same time, it was found that the proportion of patients with improved visual acuity after the operation reached 58.49%. It should be noted that among the 53 patients in this study, 5 patients had lost their vision before the operation. Considering this situation, the theoretical improvement rate of visual acuity after the operation can reach more than 60%, which is an extremely remarkable result.

Ultrasound cycloplasty is considered a revolutionary progress in ciliary body secretory function-reducing surgeries. It has the irreplaceable advantages of being minimally invasive, precise, having a short learning curve for the operation, simple operation, short operation time, not destroying the integrity of the eyeball, low infection probability, small tissue reaction, being repeatable, and being able to significantly relieve or completely relieve the patient's pain. It is a minimally invasive anti-glaucoma surgery with broad application prospects [19]. From ciliary body photocoagulation to ultrasound cycloplasty, ciliary body secretory function-reducing surgeries have made great progress, with continuously improved safety and effectiveness, and the surgical indications of ciliary body secretory function-reducing surgeries have gradually expanded. It is no longer limited to refractory glaucoma after filtration surgery or those not suitable for filtration surgery, end-stage glaucoma patients with low visual acuity requirements and only requiring symptom relief, but also provides an alternative option for some patients with milder conditions and better prognoses in the early and middle stages of glaucoma [23].

According to the research results, it was found that the reduction process of intraocular pressure after the operation is gradual and requires continuous use of intraocular pressure-lowering medications to assist in maintaining the intraocular pressure within a safe range [13]. In addition, atropine eye ointment is used after the operation to paralyze the ciliary muscle [24]. Therefore, regular reexamination and monitoring of intraocular pressure changes are crucial for evaluating the treatment effect, flexibly adjusting the nursing plan, and early detection of possible complications. Patients and medical providers should not easily stop using antihypertensive drugs unless it is determined under the strict guidance of the doctor that the intraocular pressure has stabilized at an ideal level, which requires further communication and emphasis in postoperative nursing.

At the same time, the degree of improvement in visual acuity after the operation is closely related to the health status of the optic nerve. Ultrasound cycloplasty can improve the visual acuity of patients to varying degrees, and this improvement process is usually continuous and stable. Because this surgical method can effectively reduce the intraocular pressure, thereby reducing the compression on the optic nerve and alleviating the damage to nerve fibers, it is helpful for the recovery or maintenance of visual function. In terms of pain relief, ultrasound cycloplasty has a rapid and significant effect. This surgical method directly reduces the secretory function of the ciliary body through the precise action of ultrasonic energy, thereby reducing the intraocular pressure and quickly relieving the eye discomfort

and pain caused by high intraocular pressure. In addition, the feature of no incision also reduces the pain that may be caused by the operation itself.

However, one of the significant limitations of this study is the substantial loss to follow-up, with 22 patients lost at one month and 31 patients lost at three months postoperatively. This drop-out rate raises concerns regarding the reliability and generalizability of the long-term outcome data. The loss of participants may introduce bias, as those who dropped out could differ systematically from those who completed the follow-up assessments, potentially skewing the results and limiting the interpretability of the findings. To address this limitation in future research, several strategies should be considered to minimize patient drop-out during follow-up. Firstly, incorporating more flexible follow-up methods, such as telemedicine consultations, could enhance accessibility for patients who face barriers to attending in-person visits. This approach may not only improve retention rates but also allow for timely monitoring of patient outcomes. Additionally, conducting patient satisfaction surveys could provide valuable insights into the reasons behind drop-out rates. Understanding patient experiences and challenges related to follow-up can inform the development of tailored strategies to improve engagement and adherence. For instance, adjustments to appointment scheduling, reminders, and support services could be implemented based on patient feedback. By proactively addressing these issues, future studies can ensure a more complete and representative dataset, ultimately enhancing the robustness of the findings and contributing to the advancement of clinical practices in glaucoma treatment.

In summary, ultrasound cycloplasty is simple to operate, safe, and has few complications. However, due to its relatively advanced treatment method being different from traditional anti-glaucoma surgeries, its characteristic clinical nursing is the guarantee for ensuring the safe and orderly progress of the operation. This plays an important role in the success of the operation and the recovery of the patient. Through good preoperative communication and professional knowledge education, the patient's nervousness can be alleviated, postoperative recovery can be promoted, and the occurrence of accidents can be reduced. It is worth noting that no intraoperative and postoperative complications occurred in the 53 patients in this study. The close observation of the patient's systemic reactions by the nurse during the operation and the doctor's proficient surgical skills are the keys to the success of the operation. Close observation and nursing after the operation are helpful for relieving the patient's eye pain and timely detecting and handling possible complications. Regarding the long-term efficacy and follow-up care, although ultrasound cycloplasty provides an innovative treatment option, its long-term efficacy and potential complications still need further observation and research [8] [25]. Continuous research and patient care follow-up will help to deeply understand the persistence of the effect and its impact on the quality of life within several years after the operation. Therefore, it is recommended to conduct long-term intraocular pressure monitoring and regular nursing assessment for patients

who have undergone this operation to ensure the durability and safety of the treatment results. In conclusion, for ultrasound cycloplasty, due to the particularity of its surgical principle, clinical nursing is crucial for the efficacy of the operation and the recovery of the patient, especially the preoperative and postoperative education, which helps the patient to further understand the surgical principle and steps and cooperate with the later treatment.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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