Journal of Clinical and Nursing Research, 2024, Volume 8, Issue 2
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Analysis of Ultrasonic Emulsification Surgery and Small Incision Cataract Extracapsular Extraction Surgery for Cataract Clinical Treatment Level Improvement

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Abstract: *Objective:* To analyze the efficacy of ultrasonic emulsification and small incision cataract extracapsular extraction in cataract patients. *Methods:* 96 cataract patients admitted from May 2021 to May 2023 were selected and randomly grouped into group A (ultrasonic emulsification) and group B (small-incision extracapsular cataract extraction), with 48 cases each. *Results:* At 1 week, 1-month, and 3 months post-operation, the visual acuity of group A was higher and the astigmatism value was lower than that of group B ($P < 0.05$); at 12h, 24h, and 48h post-operation, the intraocular pressure of group A was higher than that of group B ($P < 0.05$); the thickness of macular area of group A was lower than that of group B at 1 week and 1-month post-operation ($P < 0.05$). *Conclusion:* Ultrasonic emulsification in cataract patients was slightly better than small incision cataract extracapsular extraction in correcting astigmatism, improving visual acuity, and regulating macular thickness. However, due to the high energy of ultrasonic emulsification, the risk of complications such as high postoperative intraocular pressure was higher. Small-incision extracapsular cataract extraction has better application value in economically disadvantaged areas.

Keywords: Cataract; Cataract ultrasonic emulsification; Small incision cataract extracapsular extraction; Therapeutic efficacy

Online publication: February 26, 2024

1. Introduction

Cataracts account for a relatively high proportion of ophthalmic diseases and are associated with blindness, which is related to several factors such as eye trauma, age, medication, genetics, etc. The incidence rate of age-related cataracts is the highest. Currently, cataracts are treated with medication and surgery. Conservative treatment with medication can only slow down the progress of cataracts but does not cure the patient hence surgical treatment is recommended. Recently, cataract surgery technology has advanced and progressed from conventional needle dialysis to laser surgery ultrasonography, providing new ideas and insights for clinical

treatment [1]. Ultrasonic emulsification is a minimally invasive procedure but requires high-level medical equipment and physician skills, making it difficult to be promoted as a treatment. Furthermore, thermal burns and concussion injuries may occur during the intra-operative energy conversion. Small incision extracapsular cataract extraction is easy to operate and does not require special medical equipment, but the overall effectiveness of the procedure is not as ideal as compared to that of ultrasonic emulsification and is more suitable for application in grassroots hospitals. In this study, 96 cataract patients admitted from May 2021 to May 2023 were selected to investigate the efficacy of the above two surgical methods.

2. Information and methods

2.1. Data

96 cataract patients admitted from May 2021 to May 2023 were randomly grouped. As shown in **Table 1**, there were no significant differences between the data of cataract patients in group A and group B ($P > 0.05$).

Table 1. Analysis of cataract patients' data.

Group	*n*	Gender (%)		Age (years)		Course of disease (years)	
		Male	Female	Corridor	Mean	Corridor	Mean
A	48	30 (62.50)	18 (37.50)	2–8	4.25 ± 1.21	2-9	4.88 ± 1.32
B	48	31 (64.58)	17 (35.42)	3–8	4.27 ± 1.19	2-8	4.86 ± 1.29
χ^2/t	-	0.0450		0.0816		0.0751	
P	-	0.8321		0.9351		0.9403	

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) monocular onset; (2) lens turbidity, the presence of scar-like, point-like dark shadow-like changes; (3) informed consent; (4) with cataract surgery indications. Exclusion criteria: (1) coagulation disorder; (2) retinopathy; (3) vitreous lesion; (4) high myopia.

2.3. Treatment

Preoperative preparation: routine intraocular pressure and fundus examination were carried out 1 day before the operation, along with the administration of levofloxacin eye drops (Sichuan HeYi Pharmaceutical Co., Ltd.), 1 drop each time for 3–4 times a day. Tropicamide eye drops (Guangdong HengJian Pharmaceutical Co., Ltd.) were administered 1 drop each time for 2–3 times a day, 45 minutes before the operation. Pupil dilation was monitored, rinsed using saline, and routinely disinfected. Lastly, hydrochloride oxybuprocaine eye drops (Shenyang Oasis Pharmaceutical Co., Ltd.) were administered 1 drop each time, 3 times a day before surgery.

Group A underwent ultrasonic emulsification treatment. Preoperative pupil dilation and disinfection were carried out, and a short incision in the corneal limbus 2-point orientation, about 1.2 mm wide was performed to prepare for viscoelastic injection. A perforator knife was used to open the scleral tunnel incision 1.5 mm from the corneal limbus area up to a length of 3 mm. Gradual forward separation was performed to clear the circular capsulorhexis, the anterior chamber was punctured, and the viscoelastic solution was injected. The lens nucleus and residual cortex were aspirated using ultrasonic-emulsified water and the viscoelastic agent was injected into the capsular bag. Finally, the intraocular lens (IOL) was implanted into the capsular bag and the surgical incision was closed. The surgery was completed and the operated eye was bandaged.

Group B underwent the small incision cataract extracapsular extraction treatment. Firstly, a long tunnel

incision in the area of 1–2 mm was made behind the corneal limbus with an incision length of 6–7 mm, followed by corneal puncture openings in the 2.5 o'clock and 10 o'clock directions. An irrigation needle was inserted into the left puncture opening for water injection, and a 50–60 cm high perfusion bottle was connected. A homemade cystotomy needle was inserted into the right puncture opening, and the underwater ring tearing of the capsule was controlled to a diameter of 5–6 mm. Once the loose nucleus arrived at the anterior chamber area, the irrigation needle was removed, the viscoelastic agent was injected into the anterior chamber, and the crystal ring key was inserted into the back of the nucleus. At the same time, the viscoelastic agent needle was used to press the nucleus at the upper part, and the nucleus was clipped and withdrawn from the anterior chamber by using the sandwich technique to flush out the nucleus debris and pump out the residual cortex by the by perfusion pumping. The IOL was then implanted inside the capsule bag, the position of the crystal was adjusted, and the incision was closed.

2.4. Observation indicators

The visual acuity of cataract patients at different times of the day was detected using the international standard visual acuity chart, and the corneal astigmatism value was detected with computerized optometry. The intraocular pressure was detected by a non-contact intraocular pressure measuring machine, and the macular thickness was detected using imaging techniques.

2.5. Statistical analysis

The SPSS 21.0 was used to analyze the data; count data were expressed as % and analyzed using the chi-square (χ^2) test. Recorded data were expressed as mean ± standard deviation (SD) and compared using the *t*-test. Results were considered statistically significant at $P < 0.05$.

3. Results

3.1. Comparison of visual acuity and astigmatism comparison

As shown in **Table 2**, after 1 week, 1 month, and 3 months of surgery, the visual acuity of group A was higher than that of group B, and the astigmatism value was lower than that of group B ($P < 0.05$). Before surgery, there were no significant differences in visual acuity and astigmatism value between the two groups ($P > 0.05$).

Table 2. Comparison of visual acuity and astigmatism before and after surgery (mean ± SD)

Group	Vision				Cylinder (D)			
	Before surgery	1 week after surgery	1 month after surgery	3 months after surgery	Before surgery	1 week after surgery	1 month after surgery	3 months after surgery
A ($n = 48$)	0.25 ± 0.08	0.76 ± 0.11	0.81 ± 0.15	0.98 ± 0.18	0.46 ± 0.11	0.72 ± 0.15	0.56 ± 0.11	0.40 ± 0.05
B ($n = 48$)	0.26 ± 0.09	0.71 ± 0.10	0.73 ± 0.14	0.81 ± 0.16	0.47 ± 0.12	1.07 ± 0.18	0.75 ± 0.13	0.45 ± 0.07
t	0.5754	2.3302	2.7013	4.8905	0.4256	10.3491	7.7299	4.0269
P	0.5664	0.0219	0.0082	0.0000	0.6714	0.0000	0.0000	0.0001

3.2. Comparison of intraocular pressure

As shown in **Table 3**, at 12h, 24h, and 48h post-operation, the intraocular pressure of group A was higher than that of group B ($P < 0.05$); before the operation, there were no significant differences in the intraocular pressure of between the two groups ($P > 0.05$).

Table 3. Comparison of intraocular pressure before and after surgery (mean ± SD, mmHg)

Group	Before surgery	12 hours after surgery	24 hours after surgery	48 hours after surgery
A (n = 48)	14.24 ± 1.85	28.06 ± 3.91	23.21 ± 2.36	15.36 ± 1.91
B (n = 48)	14.22 ± 1.83	22.61 ± 3.88	17.11 ± 2.05	14.36 ± 1.86
t	0.0532	6.8547	13.5194	2.5987
P	0.9576	0.0000	0.0000	0.0109

3.3. Comparison of macular thickness

As shown in **Table 4**, the macular thickness of group A was lower than that of group B 1 week and 1 month after surgery ($P < 0.05$); there were no significant differences in the macular thickness between the two groups before and 3 months after surgery ($P > 0.05$).

Table 4. Comparison of macular thickness before and after surgery (mean ± SD, μm)

Group	Before surgery	1 week after surgery	1 month after surgery	3 months after surgery
A (n = 48)	230.25 ± 16.36	231.44 ± 16.25	245.36 ± 19.36	229.24 ± 16.17
B (n = 48)	230.28 ± 16.39	239.06 ± 16.72	256.73 ± 21.44	229.33 ± 16.16
t	0.0090	2.2643	2.7269	0.0273
P	0.9929	0.0259	0.0076	0.9783

4. Discussion

Cataracts account for a relatively high proportion of ophthalmic diseases and are highly prevalent among the elderly. It manifests as the clouding of lenses, which affects the projection of light onto the retinal area, resulting in blurred vision [2]. The incidence of cataracts in China increases yearly, endangering the citizens' well-being and reducing their quality of life [3], especially the elderly. Therefore, cataracts must be treated as soon as possible. Ultrasonic emulsification is a commonly used treatment procedure for cataracts, which has the advantages of small astigmatism, small incision, and fast recovery. However, this procedure requires the utilization of advanced surgical equipment [4]. In addition, middle-aged and elderly cataract patients are burdened with a hard nucleus, which requires long-term ultrasonic energy exposure during surgery. Together with the influence of corneal endothelial number, morphology, and functional abnormality, there is a risk of postoperative complications after cataract surgery, and therefore the overall medical expenses are higher [5]. Small-incision extracapsular extraction retains the advantages of extracapsular surgery, using the scleral tunnel incision to separate the nucleus from the posterior hydrodynamics after a sustained circular tear, and removing the fragmented nucleus with a crystalline collar spoon, respectively. It also requires fewer medical instruments and is a fairly simple operation, which is suitable to be promoted in grass-roots hospitals [6]. Furthermore, small-incision extracapsular extraction causes less damage to the anterior chamber iris and corneal tissue, so the risk of postoperative intraocular pressure (IOP) elevation and corneal edema is lower [7].

This study showed at 1 week, 1 month, and 3 months after surgery, the visual acuity of group A was higher than that of group B, and the astigmatism value was lower than that of group B ($P < 0.05$); at 12h, 24h, and 48h after surgery, the intraocular pressure of group A was higher than that of group B ($P < 0.05$); the macular thickness of group A was lower than that of group B ($P < 0.05$). It was suggested that ultrasonic papillomatous surgery could promote the recovery of the patient's visual acuity and can also reduce astigmatism but it has a higher risk of postoperative IOP elevation. This is because ultrasonic emulsification requires skillful personnel.

Although the efficacy is slightly better, patients with severe cataract clouding would require long-term exposure to high ultrasonic emulsion energy, so the risk of postoperative complications is slightly higher. On the other hand, small-incision extracapsular cataract extraction does not require ultrasonic emulsification and is easily operable. It is a relatively low-cost procedure and has a good prognosis for recovery. Hence, it is more suitable for treating cataracts in rural areas that have poorer economic conditions [8].

5. Conclusion

Cataract patients treated with ultrasonic emulsification surgery had slightly better outcomes, but due to the procedure's high requirements for physicians and equipment, and the high energy of ultrasonic emulsification, there is a high risk of complications. Hence, small-incision extracapsular cataract extraction is recommended to be applied in economically disadvantaged areas.

Disclosure statement

The author declares no conflict of interest.

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