

The Outcome of Manual Small Incision Cataract Surgery (MSICS) Using Ruit's Technique in Phacomorphic and Phacolytic Glaucoma at Nan Hospital, Thailand

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Objective: To evaluate the visual outcome and complications of manual small incision cataract surgery (MSICS) using Ruit's technique in the treatment of patients with phacomorphic and phacolytic glaucoma.

Materials and Methods: The medical records of 150 eyes in 147 patients with phacomorphic and phacolytic glaucoma who underwent MSICS by the Ruit's technique between January 2009 and May 2022 at Nan Hospital, were retrospectively reviewed. Out of these 150 eyes from the 147 patients, 58 eyes from 58 patients missed the six-week follow-up, and 14 eyes from 14 patients had pre-operative vision impairing pathology. Records were analyzed of the patients with pre-operative, post-operative uncorrected visual acuity (UCVA), intraocular pressure (IOP), operative time, intraoperative difficulties and complications, and post-operative complications and astigmatism in the second and sixth week after surgery for the 78 eyes out of 75 patients.

Results: Seventy-eight eyes of 75 patients treated by MSICS using Ruit's technique with IOL implanted in the posterior chamber demonstrated no significant intraoperative or post-operative complications. The post-operative UCVA at the sixth-week follow-up was 20/70 or better in 76% of the phacomorphic glaucoma group and 64% of the phacolytic glaucoma group. In the sixth week after treatment, the mean post-operative astigmatism of the phacomorphic glaucoma group was -1.4 ± 0.9 D and -1.3 ± 0.7 D for the phacolytic glaucoma group. The mean post-operative IOP in the sixth week after surgery for phacomorphic glaucoma and phacolytic glaucoma were 10.7 ± 3.7 mmHg and 9.8 ± 4.3 mmHg, respectively.

Conclusion: Manual small incision cataract surgery (MSICS) using Ruit's technique is an effective method and excellent at controlling the IOP and achieving good visual acuity with a low rate of complications for patients with phacomorphic and phacolytic glaucoma.

Keywords: Ruit's technique; Manual small incision cataract surgery; Phacomorphic glaucoma; Phacolytic glaucoma

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In Thailand, the prevalence of blindness is 0.59%⁽¹⁾. Cataracts are the main cause of blindness worldwide at 52.6%⁽²⁾ and also in Thailand at 51.9%⁽¹⁾. Phacomorphic glaucoma is an acute secondary angle-closure eye condition precipitated by an intumescent and swelling lens. The typical patient presents with the acute onset of ocular pain, ciliary injection, corneal edema, fixed dilated pupil, a shallow anterior chamber, and an IOP of more than 21 mmHg. Phacolytic glaucoma is an acute

secondary open-angle eye condition caused by the leakage of high molecular weight lens protein through the intact capsule, leading to trabecular obstruction. Mature or hypermature cataracts are present. Vision at the time of presentation may be reduced to light perception. The management of phacomorphic and phacolytic glaucoma includes initial lowering of the IOP to reduce the inflammation followed by definitive treatment for lens removal through cataract surgery^(3,4).

Cataract surgery in these cases poses challenges as the high IOP increases the risk of dreaded intraoperative complications. The presence of corneal edema, shallow anterior chamber depth, weak zonules, a thin capsule, and a hard nucleus has been reported to increase the surgical risk of cataract extraction. In developed countries, phacoemulsification with a foldable intraocular lens (IOL) is the standard of care in terms of cataract surgery. Manual small incision cataract surgery (MSICS), a technique for cataract extraction, is safe, gives excellent visual outcomes

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with low complication rates⁽⁵⁻⁷⁾, requires a short operation time, can be used in all cataract stages⁽⁸⁾ and is cheaper and less technology-dependent, thus, more cost-effective⁽⁹⁻¹¹⁾. In 1999, Ruit et al. described a new technique for MSICS⁽⁹⁾. In more than 85% of patients, post-operative Ruit's technique of MSICS attained visual acuity better than or equal to 20/70, the quality target recommended by the World Health Organization (WHO)^(9,12,13). Ruit's technique of MSICS is gaining popularity since it leads to comparable surgical outcomes and safe as phacoemulsification and is less expensive and less technology-dependent than phacoemulsification⁽¹³⁾.

Details retrieved from the database for these patients were analyzed, including demographics such as age, gender, pre-operative and post-operative uncorrected visual acuity (UCVA), intraocular pressure, operative time, intraoperative difficulties and complications, and post-operative complications and astigmatism at the second and sixth weeks after surgery.

Materials and Methods

The present study was a retrospective study. The medical records of all patients diagnosed with phacomorphic or phacolytic glaucoma at Nan Hospital, Nan Province, Thailand, between January 1, 2009 and May 31, 2022, that underwent the Ruit's technique of MSICS procedure with implantation of an IOL were reviewed. Patients with any other pre-operative ocular pathology such as age-related macular degeneration, other retinal conditions, severe glaucoma, optic atrophy, corneal scarring, amblyopia, and etc., were excluded from the study. Similarly, those patients who failed to attend the six-week follow-up were excluded from the study. The study was approved by the Research Ethics Committee (COA No. 031 Nan Hos. REC031/2022/August).

Statistical analysis was performed with the IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). Frequency table with number and percentage were described with descriptive statistics [range, mean, and standard deviation (SD)].

Results

A significant number of patients were excluded from the present study. Out of the 150 eyes from 147 patients, 58 eyes from 58 patients missed the six-week follow-up, and 14 eyes from 14 patients had pre-operative vision impairing pathology. The remaining 78 eyes from 75 patients eligible for the study were

Table 1. Demographic characteristics of the study population

Characteristics	Phacomorphic glaucoma	Phacolytic glaucoma
Total (eyes)	50	28
Age (years)		
Min-max	51 to 87	48 to 90
Mean±SD	70±9.1	74.1±9.5
Sex		
Male	17	13
Female	30	15
Pre-operative IOP (mmHg)		
Min-max	9 to 80	2 to 80
Mean±SD	42.8±18.4	37.1±17.7
Pre-operative UCVA; n (%)		
5/200 - FC 1 Ft.	3 (6.0)	0 (0.0)
HM - PL	47 (94.0)	28 (100)

IOP=intraocular pressure; UCVA=uncorrected visual acuity; SD=standard deviation; FC=finger counting; HM=hand movements; PL=perception of light

Table 2. Surgical times, intraoperative difficulties, and intra-operative complications

	Phacomorphic glaucoma	Phacolytic glaucoma
Total (eyes)	50	28
Surgical time (minutes); n (%)		
<10 minutes	3 (6.0)	2 (7.1)
10 to 20 minutes	30 (60.0)	19 (67.9)
>20 minutes	17 (34.0)	7 (25.0)
Min-max	9 to 46	9 to 30
Mean±SD	19.2±6.8	17.2±5.9
Intraoperative difficulties; n (%)		
Corneal edema	12 (24.0)	7 (25.0)
Very shallow anterior chamber	7 (14.0)	1 (3.6)
Pupillary constriction	3 (6.0)	2 (7.1)
Prolapsing nucleus difficulties	1 (2.0)	3 (10.7)
Intraoperative complications; n (%)		
Zonule dialysis with vitreous loss	1 (2.0)	1 (3.6)

SD=standard deviation

50 eyes with phacomorphic glaucoma and 28 eyes exhibiting phacolytic glaucoma. The demographic data and details of the pre-operative findings for both groups are summarized in Table 1. All participants underwent Ruit's technique of MSICS, temporal scleral approach with the implantation of a rigid polymethyl methacrylate (PMMA) IOL 6.0 mm, under local anesthesia. The 78 operations were performed by a single surgeon. Table 2 presents details of the surgical time, intraoperative difficulties, and intraoperative complications of the enrolled patients. Patients were examined on the first

post-operative day, then followed up at two weeks, and finally at six weeks (Table 3).

The mean surgical times of the phacomorphic and phacolytic groups were 19.2 ± 6.8 minutes and 17.2 ± 5.9 minutes, respectively. In the present study, corneal edema was found to be the most common intraoperative difficulty in both groups, with phacomorphic glaucoma at 24% (12/50) and phacolytic glaucoma at 25% (7/28). In both groups, one case of zonule dialysis with vitreous loss occurred during the operation, thus, for the phacomorphic group at 2% (1/50) and for the phacolytic glaucoma at 3.6% (1/28) (Table 2).

Both phacomorphic and phacolytic glaucoma patients achieved good visual results after MSICS. At two weeks, 58% and 50% of the patients in the phacomorphic and phacolytic groups, respectively, achieved UCVA of 20/70 or better and improved to 76% and 64.2%, respectively, at the six-week follow-up (Table 3).

At the two-week follow-up, the average keratometric astigmatism of the phacomorphic glaucoma group was -1.3 ± 0.8 D and -1.8 ± 0.9 D in the phacolytic glaucoma group. At the six-week follow-up, the mean corneal astigmatism of the phacomorphic glaucoma group was -1.4 ± 0.9 D and -1.3 ± 0.7 D in the phacolytic glaucoma group. In the present study, both groups achieved excellent intraocular pressure control results without requiring antiglaucoma medications. The mean IOP of the phacomorphic and phacolytic groups were 10.3 ± 3.1 mmHg and 10.3 ± 5.7 mmHg, respectively, at the two-week follow-up examination. The mean IOP at six weeks post-operatively was 10.7 ± 3.7 mmHg for the phacomorphic glaucoma group and 9.8 ± 4.3 mmHg for the phacolytic glaucoma group.

Eleven cases of persistent pupillary dilatation were determined at six weeks post-operative, seven eyes (14%) in the phacomorphic group and four eyes (14.3%) in the phacomorphic group. No major post-operative complications were observed such as endophthalmitis or retinal detachment during the follow-up (Table 3).

Discussion

A shallow anterior chamber with high intraocular pressure is a common occurrence in phacomorphic glaucoma. Extra-capsular cataract extraction (ECCE) requires a large incision in a globe with very high intraocular pressure and more surgical manipulation, which increases the risk of sight-threatening complications such as expulsive or suprachoroidal

Table 3. Post-operative outcomes in the second and sixth week

Outcomes	Phacomorphic glaucoma	Phacolytic glaucoma
Total (eyes)	50	28
Post-operative IOP two weeks (mmHg)		
Min-max	4 to 17	3 to 25
Mean \pm SD	10.3 ± 3.1	10.3 ± 5.7
Post-operative IOP six weeks (mmHg)		
Min-max	4 to 21	3 to 17
Mean \pm SD	10.7 ± 3.7	9.8 ± 4.3
Post-operative UCVA two weeks; n (%)		
$\geq 20/70$	29 (58.0)	14 (50.0)
<20/70 to 20/200	16 (32.0)	11 (39.3)
<20/200	5 (10.0)	3 (10.7)
Post-operative UCVA six weeks; n (%)		
$\geq 20/70$	38 (76.0)	18 (64.3)
<20/70 to 20/200	11 (22.0)	10 (35.7)
<20/200	1 (2.0)	0 (0.0)
Post-operative astigmatism two weeks (diopter); n (%)		
< -1.0	16 (32.0)	4 (14.3)
-1.0 to -2.0	27 (54.0)	13 (46.4)
> -2.0	7 (14.0)	11 (39.3)
Mean \pm SD	-1.3 ± 0.8	-1.8 ± 0.9
Post-operative astigmatism six weeks (diopter); n (%)		
< -1.0	14 (28.0)	9 (32.1)
-1.0 to -2.0	29 (58.0)	15 (53.6)
> -2.0	7 (14.0)	4 (14.3)
Mean \pm SD	-1.4 ± 0.9	-1.3 ± 0.7
Post-operative complications six weeks; n (%)		
Corneal edema	2 (4.0)	0 (0.0)
Pupillary dilatation	7 (14.0)	4 (14.3)
Mild iritis	0 (0.0)	2 (7.1)
Vitreous in the anterior chamber	0 (0.0)	1 (3.6)

IOP=intraocular pressure; UCVA=uncorrected visual acuity; SD=standard deviation

hemorrhage. Phacoemulsification presents challenges in cases of phacomorphic glaucoma due to an increased risk of complications such as a shallow chamber, iris prolapse, and peripheral capsulorrhexis tears. Moreover, the risk of corneal endothelial injury is greater because of the proximity of the phaco tip during nucleus emulsification and the reduced endothelial reserve in these patients.

MSICS creates less stress on lens zonules, and the anterior chamber is more stable due to the shelving scleral wound, along with minimal surgical-related complications. MSICS has been shown to have favorable outcomes in terms of vision and safety in these cases^(7,14-16). The author found that the mean of pre-operative ocular tension in phacomorphic glaucoma was 42.8 mmHg. The pre-operative ocular

tension in phacolytic glaucoma was 37.1 mmHg. At the six-week follow-up, the mean ocular tension in phacomorphic glaucoma was 10.7±3.7 mmHg, less than the 12.7 mmHg reported by Ramakrishnan et al⁽⁷⁾. The mean ocular tension in phacolytic glaucoma was 9.8 mmHg, less than the 12.6 mmHg reported by Noman et al.⁽¹⁵⁾ and the 15.1 mmHg reported by Venkatesh et al⁽¹⁶⁾.

At the six-week follow-up, the phacolytic group exhibited mean astigmatism of -1.3±0.7 D. Gogate et al.⁽¹⁷⁾ reported 1.2 D of surgically induced astigmatism. The result of astigmatism post-operative in the present study is similar to that reported in previous work. The present study found that UCVA of 20/70 or better in 64.3% (18/28) for the phacolytic group at the six-week follow-up, lower than the 71.1% reported by Gogate et al⁽¹⁷⁾. The ten eyes (35.7%) with UCVA of 20/70 or worse had post-operative astigmatism of -1.75 to -3.5 D. One reason for the number of patients achieving UCVA of 20/70 or better in the present study compared to the other study could be that a reduced degree of post-operative astigmatism results in better visual acuity.

The author found zonule dialysis with vitreous loss to be the only intraoperative complication in both groups. In each of the phacomorphic groups, only one case was found, constituting 2% (1/50), and in the phacolytic group, a single case represented 3.6% (1/28). Ramakrishnan et al.⁽⁷⁾ reported an 8.1% incidence of intraoperative complications in phacomorphic glaucoma performed with MSICS. Venkatesh et al.⁽¹⁶⁾ reported a 9.1% incidence of phacolytic glaucoma intraoperative complications.

Both phacoemulsification and Ruit's technique of MSICS give excellent visual outcomes with low complication rates. MSICS is also much more cost-effective than phacoemulsification⁽¹³⁾. The high cost of the phacoemulsification machine is related to the consumables and maintenance required. Ruit et al.⁽¹³⁾ reported US\$ 70 per case for phacoemulsification and US\$ 15 per case for MSICS. Furthermore, the use of expensive foldable IOLs is the confounding variable for phacoemulsification. Ruit et al.⁽¹³⁾ reported US\$ 52 per case for phacoemulsification and US\$ 5 per case for MSICS. MSICS is a more cost-effective and financially viable option for many settings in the developing world.

The advantage of the present study is that it provides a long-term retrospective review with one surgeon experiencing a difficult situation. However, one limitation is that it involves a retrospective analysis and a small number of cases. Furthermore,

the patients of the present study did not receive the best corrected visual acuity (BCVA). A prospective study with a larger sample size and BCVA evaluation is required in the future.

In conclusion, Ruit's technique of MSICS is an effective method and excellent for controlling intraocular pressure and achieving good visual acuity with a low rate of complications. The present study suggests that the use of Ruit's technique of MSICS is appropriate for patients with phacomorphic and phacolytic glaucoma in developing countries.

What is already known on this topic?

MSICS is a safe and cost-effective technique for cataract extraction, producing good visual outcomes with low complication rates. MSICS is shown to have satisfactory results in the management of phacomorphic and phacolytic glaucoma.

What does this study add?

Ruit's technique of MSICS is a high-quality procedure that achieves excellent clinical outcomes with a low rate of complications for phacomorphic and phacolytic glaucoma in developing countries. The author has used this technique at Nan Hospital, Thailand for more than 13 years. The present study demonstrates the favorable outcomes achieved with this technique.

Conflicts of interest

The author declares no conflict of interest.

References

1. Jenchitr W, Harnutsaha P, Iamsirithaworn S, Pamrat U, Choosri P, Yenjit C. The National survey of blindness, low vision and visual impairment in Thailand 2006-2007. *Thai J Public Health Ophthalmol* 2007;21:10-94.
2. Bourne RRA, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jonas JB, et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. *Lancet Glob Health* 2017;5:e888-97.
3. American Academy of Ophthalmology. Normality or abnormality of the visual field. In: Girkin CA, editor. *Basic and Clinical Science Course (BCSC), Section 10: Glaucoma*. San Francisco: AAO; 2016. p. 97-8.
4. Bagheri N, Wajda BN. Phacolytic glaucoma / Phacomorphic glaucoma. In: Bagheri N, Wajda BN, editors. *The Wills eye manual: office and emergency room diagnosis and treatment of eye disease*. 7th ed. Philadelphia, PA: Wolters Kluwer; 2017. p. 393-6.

5. Rijal AP, Karki DB. Visual outcome and IOP control after cataract surgery in lens induced glaucomas. Kathmandu Univ Med J (KUMJ) 2006;4:30-3.
6. Prajna NV, Ramakrishnan R, Krishnadas R, Manoharan N. Lens induced glaucomas--visual results and risk factors for final visual acuity. Indian J Ophthalmol 1996;44:149-55.
7. Ramakrishnan R, Maheshwari D, Kader MA, Singh R, Pawar N, Bharathi MJ. Visual prognosis, intraocular pressure control and complications in phacomorphic glaucoma following manual small incision cataract surgery. Indian J Ophthalmol 2010;58:303-6.
8. Astbury N. Converting from ECCE to SICS. Community Eye Health 2009;22:6-7.
9. Ruit S, Tabin GC, Nissman SA, Paudyal G, Gurung R. Low-cost high-volume extracapsular cataract extraction with posterior chamber intraocular lens implantation in Nepal. Ophthalmology 1999;106:1887-92.
10. Hennig A, Kumar J, Yorston D, Foster A. Sutureless cataract surgery with nucleus extraction: outcome of a prospective study in Nepal. Br J Ophthalmol 2003;87:266-70.
11. Venkatesh R, Muralikrishnan R, Balent LC, Prakash SK, Prajna NV. Outcomes of high volume cataract surgeries in a developing country. Br J Ophthalmol 2005;89:1079-83.
12. Ruit S, Paudyal G, Gurung R, Tabin G, Moran D, Brian G. An innovation in developing world cataract surgery: sutureless extracapsular cataract extraction with intraocular lens implantation. Clin Exp Ophthalmol 2000;28:274-9.
13. Ruit S, Tabin G, Chang D, Bajracharya L, Kline DC, Richheimer W, et al. A prospective randomized clinical trial of phacoemulsification vs manual sutureless small-incision extracapsular cataract surgery in Nepal. Am J Ophthalmol 2007;143:32-8.
14. Rajkumari V, Singh Kaminibabu K, Bhabanisana RD, Victor R. Manual small incision cataract surgery in phacomorphic glaucoma: Surgical technique and outcome in North-eastern India. J Curr Glaucoma Pract 2013;7:43-8.
15. Noman SM, Karim MA. Visual outcome after manual small incision cataract surgery for phacolytic glaucoma. Ophthalmol Res: Int J 2020;13:54-9.
16. Rengaraj V, Colin SHT, Thangavel Thirumalai K, Ravilla DR. Safety and efficacy of manual small incision cataract surgery for phacolytic glaucoma. Br J Ophthalmol 2007;91:279-81.
17. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, et al. Safety and efficacy of phacoemulsification compared with manual small-incision cataract surgery by a randomized controlled clinical trial: six-week results. Ophthalmology 2005;112:869-74.