WORLD VIEW

Safety and efficacy of manual small incision cataract surgery for phacolytic glaucoma

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Aims: To evaluate the safety, visual outcome and complications of manual small incision cataract surgery (MSICS) in the treatment of patients with phacolytic glaucoma.

Methods: In a nonrandomised interventional case series, 33 consecutive patients with phacolytic glaucoma underwent cataract extraction by MSICS, with staining of the anterior capsule by trypan blue.

Results: The mean preoperative intraocular pressure (IOP) was 46.2 mmHg. No significant intraoperative complications such as posterior capsule rupture or expulsive hemorrhage occurred. In 31 patients (93.9%), an intraocular lens (IOL) was implanted in the posterior chamber. In two of 33 patients (6.1%), the posterior capsule was removed and the patient was left aphakic because of severe pre-existing zonulysis. The postoperative best-corrected visual acuity was 20/60 or better in 29 cases (87.9%) and 20/40 or better in 26 patients (78.8%). The IOP was 22 mmHg or less in all 33 cases without the use of anti-glaucoma medications and the mean IOP was 15.1 mmHg (range, 7–22, SD $\pm$ 3.9). Postoperative corneal edema occurred in 11 cases (33.3%) and anterior chamber inflammation was present in nine cases (27.3%). Both conditions resolved with standard medical therapy.

Conclusion: Manual small incision cataract surgery with trypan blue staining of the anterior capsule is a safe and effective method of cataract extraction for patients with phacolytic glaucoma.

Blindness affects an estimated 12.5 million people in India, with cataracts the cause in 50 to 80% of this group.[1–4] This, together with social and economic factors, often result in delayed presentation until advanced stages such as intumescent, mature, and hypermature cataracts. Hence, complications such as phacolytic glaucoma are more common.

The definitive treatment for phacolytic glaucoma is cataract extraction.[5–7] Cataract surgery in patients with phacolytic glaucoma poses several challenges: the high intraocular pressure (IOP) increases the risk of expulsive hemorrhage, the nucleus is hard, and there is often zonulysis which makes surgery technically more difficult. Manual small incision cataract surgery (MSICS) is popular in developing countries as it is inexpensive and allows high-volume cataract surgery without compromising quality of medical care.[8–10]

Our study aimed to evaluate the safety, visual outcome, and complications of MSICS in the management of patients with phacolytic glaucoma.

METHODS

This non-randomised, interventional case series study was conducted at the Aravind Eye Hospital, Pondicherry, India and was approved by the hospital's Institutional Review Board. All patients diagnosed with phacolytic glaucoma between January and December 2004 were included in the study. The patients were referred from local hospitals covering an area of 50 km^2 in the state of Pondicherry, India.

The diagnosis of phacolytic glaucoma was based on the signs and symptoms described by Mandal and Gothwal,[11] specifically, a mature or hypermature cataract and the presence of liquid cortex or small chunks of lens material in the anterior chamber. The preoperative assessment included slit-lamp examination, applanation tonometry, gonioscopy and B-scan ultrasonography to exclude posterior segment pathology. Patients with IOP greater than 35 mmHg were treated medically prior to surgery. All 33 surgeries were performed by a single surgeon (RV).

Surgical technique

Preoperatively, 200 ml of intravenous mannitol 20% and retrobulbar with facial block were administered. The surgical steps of MSICS have previously been described.[8] Briefly, after a superior fornix-based conjunctival flap, a partial thickness 6.0–6.5 mm scleral incision was made 2 mm behind the limbus and a scleral tunnel was extended 1 mm into clear cornea. An additional paracentesis made at the 10 o'clock position. The anterior chamber was filled with an air bubble and 0.1 ml of 0.06% trypan blue (Auroblue, Aurolab, India) was injected under the air bubble. After several seconds, viscoelastic (Aurovisc, Aurolab, India) was used to displace the air bubble. The anterior chamber was entered with a keratome. A small nick was made in the anterior capsule using a bent 26G needle mounted on a syringe and liquid cortex was aspirated. The capsular bag was inflated with viscoelastic and the continuous curvilinear capsulorrhexis (CCC) was completed using an utrata capsulorrhexis forceps. A Sinskey hook was used to hook out one pole of the nucleus outside the capsular bag and the rest of the nucleus was rotated out into anterior chamber. For cases with zonular compromise, a bimanual prolapse technique was employed: a cyclodialysis spatula inserted through the side port incision was placed under the nucleus and used as a fulcrum to dial the nucleus out of the capsular bag. Using this technique, the cyclodialysis spatula absorbs the rotational forces, minimising stress on the zonules.

The nucleus was extracted out of the eye using an irrigating vectis (Indogerman, India) After aspiration of remaining cortex, a 6-mm optic polymethyl methacrylate (PMMA) posterior chamber intraocular lens (Aurolab, India) was implanted into the capsular bag. The viscoelastic material was aspirated and both the wound and paracentesis were hydrated with BSS. The conjunctival flap was opposed using a forceps fitted to bipolar diathermy.

Abbreviations: CCC, continuous curvilinear capsulorrhexis; ECCE, extracapsular cataract extraction; IOL, intraocular lens; IOP, intraocular pressure; MSICS, manual small incision cataract surgery; OCTET, Oxford Cataract Treatment and Evaluation Team; PMMA, polymethyl methacrylate

Table 1 Demographic characteristics of the study population

Demographics	Number of patients (%)
Age (Years)	
Mean (± SD)	63.1 (±9.1)
Range	42–84
Gender	
Male	16 (48.5)
Female	17 (51.5)
Operated eye	
Right eye	15 (45.5)
Left eye	18 (54.6)
Status of fellow eye	
Pseudophakic	14 (42.4)
Aphakic	11 (33.3)
Immature cataract	7 (21.2)
Mature cataract	1 (3.0)
Duration of Symptoms (Days)	
Mean (± SD)	6.2 (± 4.0)
0–5	15 (45.5)
6–10	14 (42.4)
11–15	4 (12.1)
Preoperative IOP (mm Hg)	
Mean (± SD)	46.2 (±12.3)
25–45	18 (54.5)
46–65	15 (45.5)
Best-corrected visual acuity	
Hand movements	14 (42.4%)
Light perception	19 (57.6%)
Systemic medical conditions	
Nil	23 (69.7)
Diabetes	2 (6.1)
Hypertension	5 (15.2)
Diabetes & Hypertension	3 (9.1)

Postoperatively, patients were treated with topical antibiotics and steroids for next six weeks. The intra- and postoperative complications were graded according to Oxford Cataract Treatment and Evaluation Team (OCTET) classification.[12] On the 40th postoperative day, patients underwent an independent ophthalmic examination by a trained ophthalmologist.

All statistical analyses were performed using SPSS version 12.0 (SPSS Inc, Chicago, Illinois, USA). χ^2 tests were used to compare the results of categorical variables, and unpaired *t*-tests used to compare means, with *P*-values <0.05 considered statistically significant.

RESULTS

The demographic details of the 33 patients are presented in table 1. Intraoperatively, there were no sight-threatening complications such as expulsive hemorrhage and no posterior capsule rupture during any of the surgeries. In 31 patients (93.9%), an IOL was implanted in the posterior chamber, although of these, one patient (3.0%) had zonular dialysis, which was stabilised by a capsular tension ring. In the remaining two patients (6.1%), the posterior capsule was removed and patient was left aphakic because of pre-existing poor zonular support.

On the first postoperative day, there were a total of 21 complications in 18 of 33 patients (54.5%) according to the OCTET classification (table 2). Vitreous opacities were an incidental finding in two patients. However, there were no other clinical features of endophthalmitis and the opacities resolved with topical steroid therapy over the next few months.

The preoperative and postoperative visual acuities are summarised in table 3. By the 40th postoperative day, the best-corrected visual acuity was 20/60 or better in 29 patients (87.9%) and 20/40 or better in 26 patients (78.8%). The mean post-operative cylinder was +1.60 D (range, 0.5 to 3.00D, SD ± 0.66). The median axis was 180° (range, 15° to 180°). The IOP on the final visit was ⩽22 mmHg in all 33 patients without the use of antiglaucoma medications, with a mean IOP of 15.1 mmHg (range, 7–22, SD ±3.9).

Table 2 Postoperative findings on day 1 according to the OCTET[11] classification

	OCTET Grade	Number of eyes*	Percentage [95% confidence interval]
Corneal oedema with Descemet's folds >10	1	3	9.1 [2.38, 25.47]
Corneal oedema with Descemet's folds <10	1	8	24.2 [11.74, 42.63]
Mild Iritis <50 cells	1	5	15.2 [5.72, 32.67]
Moderate to severe iritis with fibrin membrane	2	4	12.1 ([3.96, 29.14])
Vitreous in anterior chamber not touching cornea	1	1	3.0 [0.16, 17.51]
Total	–	21	63.6 [45.14, 79.04]

*Eighteen of 33 eyes (54.5%) had one or more complications, giving a total of 21 complications.

The mean postoperative IOP on day 40 was higher for males (15.6 mmHg, SD ± 4.1) compared to females (13.7 mmHg, SD ± 3.2) ($P = 0.029$). There was no significant association between the postoperative IOP and preoperative IOP ($r = 0.182$, $P = 0.311$), duration of symptoms ($r = 0.198$, $P = 0.271$), or age of the patient ($r = -0.028$, $P = 0.876$). Similarly, corneal edema or iritis was not significantly associated with the age, gender, IOP or duration of symptoms.

Comparing the patients with symptoms for less than 7 days against patients with symptoms of 7 days or longer, there was no difference in the mean pre- or postoperative IOP, presence of corneal edema, iritis, or BCVA postoperatively (table 4).

DISCUSSION

Our study demonstrates that MSICS can be performed safely in patients with phacolytic glaucoma and produce good visual outcomes. Phacolytic glaucoma is caused by an obstruction of trabecular meshwork by lens proteins or protein-laden macrophages.[13 14] The authors believe that in such patients, MSICS with trypan blue staining of the anterior capsule has advantages over both extracapsular cataract extraction (ECCE) and phacoemulsification. ECCE requires a large incision in a globe with very high IOP, which increases the risk of sight threatening complications such as expulsive hemorrhage;[15] the surgical steps are technically more challenging and may be complicated by iris tissue prolapse through the large limbal wound. It has been shown that MSICS gives better uncorrected vision compared to ECCE[7] due to higher postoperative astigmatism in ECCE. Phacoemulsification can be difficult in phacolytic glaucoma because the nuclei are very dense and hard and the capsule and zonules are often compromised, giving little support. There is higher risk of endothelial damage, zonular dialysis, and posterior capsule rupture. In contrast, MSICS places less stress on the zonules, does not require expensive equipment like phacoemulsification and the anterior chamber is more stable due to the shelving scleral wound.

During MSICS, the adjunctive use of trypan blue[16] to stain the anterior capsule enhances the safety and ease of nucleus prolapse because it aids visualisation of the capsular rim, allowing detection of compromise to the capsular bag. Should this occur, relaxing incisions can be made, thereby avoiding the intracapsular removal of the nucleus.[17]

The corneal edema and anterior chamber inflammation detected on the first postoperative day is not unusual considering the intense inflammation associated with phacolytic glaucoma and resolved with medical therapy without long-term visual sequelae.

By the 40th postoperative day, 87.9% of our patients had good visual outcome according to the WHO criteria of best-corrected

Table 3 Comparison of pre- and postoperative visual acuities

Visual acuity	Preoperative VA Number (%)	Postoperative uncorrected VA Number (%)	Postoperative best-corrected VA Number (%)
20/20–20/30	0 (0.0)	2 (6.1)	20 (60.6)
20/40–20/60	0 (0.0)	11 (33.3)	9 (27.3)
20/80–20/120	0 (0.0)	11 (33.3)	3 (9.1)
20/160–20/200	0 (0.0)	1 (3.0)	0 (0.0)
Worse than 20/200	33 (100.0)	8 (24.2)	1 (3.0)

visual acuity of 20/60 or better, 78.8% of our patients had best-corrected visual acuity of 20/40 or better and 20 eyes (60.6%) having visual acuity between 20/20–20/30. This compares favorably with other series in which ECCE was performed.[5 11 18 19] The mean postoperative astigmatism of our patients is comparable to a series where MSICS was performed in 191 eyes where the mean astigmatism was 1.20D, SD ± 0.8.[20] Interestingly, the steep axis was 180 in 18 of 26 patients (69.2%) whose vision improved with refraction, possibly due to relaxation caused by the superior scleral incision. A single suture placed superiorly may help to reduce postoperative astigmatism. Of the four eyes with best corrected visual acuity worse than 20/60, two had preexisting diabetic retinopathy or macular edema, one had optic disc pallor, and one had central retinal vein occlusion. This likely was secondary to the prolonged raised intraocular pressure (>50 mmHg for 10 days) associated with the phacolytic glaucoma. None of these conditions were the result of the surgical technique itself. In all our cases, the IOP was controlled without the need for long-term anti-glaucoma medications. This is a result similar to other studies on ECCE performed for phacolytic glaucoma.[5 11 19]

The vitreous opacities noted in two cases are consistent with those previously described by Thomas et al[21] in five cases of phacolytic glaucoma. Similar to the earlier series, our patients' initial symptoms lasted more than 7 days (7 and 10 days respectively) and the vitreous opacities resolved spontaneously. These vitreous opacities might be the result of an enhanced inflammatory response and were likely present prior to cataract surgery.[21] However, since they are usually noticed only after cataract removal, they can be mistaken for endophthalmitis.

Table 4 Effect of duration of symptoms on surgical complications and outcomes

	Duration of symptoms		
	Less than 7 days, Number (%)	More than 7 days, Number (%)	*P* value
Preoperative IOP			
Mean (± SD)	46.9 (± 10.4)	45.5 (± 14.3)	0.752
Postoperative IOP			
Mean (± SD)	14.3 (± 3.8)	15.9 (± 3.9)	0.249
Corneal edema			
Present	6 (35.3)	5 (31.3)	1.000
Absent	11 (64.7)	11 (68.8)	
Iritis			
Present	3 (17.6)	6 (37.5)	0.259
Absent	14 (82.4)	10 (62.5)	
Postoperative uncorrected visual acuity			
20/20–20/60	8 (47.1)	5 (31.3)	0.608
20/80–20/200	5 (29.4)	7 (43.8)	
Worse than 20/200	4 (23.5)	4 (25.0)	
Postoperative best-corrected visual acuity			
20/20–20/60	15 (88.2)	14 (87.5)	0.512
20/80–20/200	1 (5.9)	2 (12.5)	
Worse than 20/200	1 (5.9)	0 (0.0)	

The authors are not aware of any previous studies on the safety, efficacy and complications of MSICS in the treatment of eyes with phacolytic glaucoma. In a developing country like India, phacolytic glaucoma is not an uncommon presentation in the population. Our study demonstrates that MSICS is a safe and effective treatment for patients with phacolytic glaucoma, especially with the adjunctive use of trypan blue dye staining of the anterior capsule.

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