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Original article

Visual outcome of conventional extracapsular cataract extraction with posterior chamber intraocular lens implantation versus manual small-incision cataract surgery

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Abstract

Background: An effective method for cataract surgery should be identified to combat cataract blindness.

Aim: To study the surgical outcome of conventional extracapsular cataract extraction versus manual small-incision cataract surgery.

Materials and methods: A randomized clinical trial was carried out including one hundred eyes (88 patients) which were divided into two groups using systematic randomization: groups of conventional extracapsular cataract extraction with posterior chamber intraocular lens (ECCE with PCIOL) implantation and manual small-incision cataract surgery (MSICS). The postoperative parameters/variables studied were the unaided and best-corrected visual acuity and astigmatism.

Statistics: Epi info 2000 version statistical software was used for data analysis and calculation of relative risk, 95% CI and p value. The p value of less than 0.05 was considered as significant.

Results: In the immediate postoperative period, unaided visual acuity of =/> 6/18 was achieved in 24 subjects in MSICS group versus 7 in ECCE with PCIOL group (RR=2.05, 95% CI=1.44 - 2.94, p = 0.0002), whereas the same at 6 - 8 weeks postoperatively was found in 28 and 22 subjects in those groups respectively (RR=1.27, 95% CI=0.86-1.89, p=0.23). The astigmatism of =/> 2 at 6 - 8 weeks was found in 35 and 17 subjects from the conventional and MSICS groups respectively (R=2.28, 95% CI = 1.39-3.73, p=0.0002).

Conclusion: Both MSICS and conventional ECCE with PCIOL are safe and effective techniques for treatment of cataract patients. A more rapid recovery of good vision can be achieved with MSICS than with conventional ECCE with PCIOL in the immediate postoperative period.

Key words: ECCE, MSICS, visual acuity, astigmatism

Introduction

Cataract is the leading cause of blindness worldwide. It is estimated that 20 million people are blind because of cataract. This backlog of patients in need of surgery is increasing because of population growth and longevity (Arvind Eye Hospital and Seva Foundation, AEH & SF, 2001). Approximately 7 million cataract operations are performed worldwide annually. With no change in current practices, the number of cataract blind in the

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world will double by the year 2020 (AEH & SF, 2001). Surgical volumes must increase to 20 million annually worldwide by the year 2010, and to 32 million operations annually if the backlog and the newly blind are to be treated by the year 2020 (Balent, 2001). Two main goals of cataract surgery in recent times are to minimize induced astigmatism and achieve rapid visual recovery. Hence, the aspect of increasing surgical volumes involves choice of surgical technique. The ideal goal is to provide high quality, high volume eye surgery in the face of limited resources in developing nations (AEH & SF, 2001).

The cost incurred in phacoemulsification does not allow it to be the ideal method of surgery of cataract extraction for the mass in developing countries where possession of sophisticated expensive instruments is not viable for most institutions (Hennig, 2003). MSICS is an appropriate technique to tackle the backlog of cataract surgery in the developing countries (Smith, 2003). Hence, it is termed as the "cataract surgery for the 21st century" (Gogate, 2003).

This study was carried out with the objective to compare the surgical outcome of conventional ECCE with PCIOL implantation versus manual small-incision cataract surgery.

Materials and methods

The study was conducted at the Nepal Eye Hospital, Kathmandu, Nepal, from April 2004 to August 2005. A total of 100 eyes of 88 patients of cataract were selected using systematic randomization sampling technique for their division into two groups: ECCE with PCIOL (Group A) and MSICS (Group B). Cataract patients with no local or systemic diseases were included in the study.

The exclusion criteria were any ocular co-morbidity capable of compromising vision, for e. g. patients with central corneal opacity, glaucoma, diabetics with significant fundus changes, patients with inflammatory eye diseases, etc. Informed consent was obtained from the patients for enrollment in the study.

Pre-operative assessment of the cataract patients included visual acuity measurement, extraocular motility evaluation, examination with slit lamp, fundus evaluation, intraocular pressure measurements, biometry and general physical examination. Macular function tests, syringing of the lacrimal passage, blood sugar and blood pressure measurement were also performed pre-operatively. The two planned treatments were ECCE and MSICS. In both techniques, a posterior chamber IOL was implanted.

Surgical technique

In ECCE, a 10-12 mm corneo-scleral section was made, the lens capsule opened and the lens nucleus expressed with wire vectis after hydro-procedures. The Simcoe cannula was then used to remove the remaining cortical matter and PCIOL was inserted into the capsular bag. The incision was closed by continuous shoelace suture with 10-0 nylon. In MSICS, a 6.5 to 7mm scleral tunnel was created with a frown incision. A side port was created to facilitate intraocular manipulations. After can opener capsulotomy, the nucleus was brought into the anterior chamber. Viscoelastic was injected around the nucleus. The nucleus was then delivered through the scleral tunnel. The remaining cortex was removed with Simcoe cannula and PCIOL was implanted in the bag. The integrity of the tunnel was confirmed by injecting basal salt solution (BSS) through the side port at the conclusion of the surgery.

Visual outcome and postoperative complications were assessed from the first postoperative day. Subsequent examination of the operated eye was done daily for 2-3 days and the patient was discharged on the 1st to 3rd postoperative day, depending on the condition of the eye.

Subsequently, the patients were reviewed at 1-2 weeks, 3-4 weeks, and 6-8 weeks post-operatively. At the end of 6-8 weeks, the final unaided visual acuity was recorded. The best-corrected visual acuity with the type of astigmatism was noted by objective and subjective refraction.

An informed consent was obtained in a pre-designed consent form for enrollment in the study; surgical and medical treatment was provided for the patients. The patients were not imposed to any risk due to the treatment provided as the standard protocol was followed for patient management.

Statistics

Epi info version 2000 statistical software was used for data analysis and calculation of relative risk, 95% CI and p value. The p value of less than 0.05 was considered as significant.

Results

Fifty eyes each were operated on using conventional ECCE with PCIOL implantation and manual small-incision cataract surgery. The age of the patients ranged from 35years to 93 years. Female patients were more in number (52.3% versus 47.7%). According to ethnicity, 31% of the enrolled patients were Newars followed by 30.7% Chhetri, 18.2% Mongoloids, 15.9% Brahmin, 2.3% Terai origin and 1.1% others. 62.5% patients were from Kathmandu Valley and 37.5% were from outside the valley.

Table 1

Description of patients according to age groups

Age in years	Number	Percentage
Less than 40	1	1.1
40-49	14	15.9
50-59	20	22.7
60-69	24	27.3
70-79	22	25
80 and above	7	8
Total	88	100

All 88 patients presented with painless progressive diminution of vision with duration ranging from 1 month to 30 months, with the mean ± SD of 15.5 ± 8.803 months.

Table 2

Preoperative visual acuity (100 eyes of 88 patients)

Visual acuity	Number	Percentage
6/24	1	1
6/36	9	9
6/60	13	13
3/60	13	13
1/60	15	15
Finger counting	13	13
Hand movement	11	11
Perception of light	25	25
Total	100	100

Visual acuity was measured with Snellen's chart and Illiterate E chart. Preoperative visual acuity was 6/24 in 1%, 6/36 in 9%, 6/60 in 13%, 3/60 in 13%, 1/60 in 15%, counting finger in 13% of patients, hand movement in 11% and perception of light in 25%.

Table 3

Morphologic type of cataract

Type	Number	Percentage
Posterior sub-capsular	48	48
Nuclear sclerosis	35	35
Total cataract	46	46
Total	100	100

Regarding the morphologic type of cataract on presentation, posterior subcapsular cataract was present in 48%, nucleus sclerosis in 35% and total cataract in 46%. On funduscopy, 32% were normal and in 68%, the fundus was not visible and a B scan was done where the posterior segment was normal. Patients with total cataract included the ones with cortical cataract also.

Table 4

Unaided postoperative visual acuity at discharge according to the type of surgery

Visual acuity	Type of surgery Conventional ECCE + PCIOL		MSICS		Total	
	No.	%	No.	%	No.	%
6/9			3	6	3	3
6/12	2	4	8	16	10	10
6/18	5	10	13	26	18	18
6/24	20	40	10	20	30	30
6/36	12	24	7	14	19	19
6/60	9	18	8	16	17	17
Finger	1	2	1	2	2	2
counting Hand movement	1	2			1	2
Total	50	100	50	100	100	100

Postoperative visual acuity at discharge was 6/18 or better in 14% in conventional ECCE with PCIOL and in 48% in Manual Small-Incision Cataract Surgery

(RR=2.05, 95% CI 1.44 - 2.94, p=0.0002).

Table 5
Unaided postoperative visual acuity (6-8 weeks) according to type of surgery

Visual acuity	Type of surgery Conventional ECCE with PCIOL		MSICS		Total	
	No.	%	No.	%	No.	%
6/6	0	0	1	2	1	1
6/9	4	8	2	4	6	6
6/12	3	6	14	28	17	17
6/18	15	30	11	22	26	26
6/24	6	12	8	16	14	14
6/36	8	16	10	20	18	18
6/60	11	22	3	6	14	14
3/60	3	6	1	2	4	4
Total	50	100	50	100	100	100

Postoperative visual acuity at 6-8 weeks was 6/18 or better in 44% in ECCE with PCIOL and in 56% in MSICS (RR=1.27, 95% CI=0.86-1.89, p value=0.23).

Table 6
Best-corrected visual acuity (6-8 weeks)

Visual acuity	Type of surgery Conventional ECCE with PCIOL		MSICS		Total	
	No.	%	No.	%	No.	%
6/6	4	8	8	16	12	12
6/9	14	28	26	52	40	40
6/12	18	36	12	24	30	30
6/18	9	18	3	6	12	12
6/24	4	8	1	2	5	5
6/36	1	2			1	1
Total	50	100	50	100	100	100

Corrected visual acuity was 6/18 or better in 90% in conventional ECCE with PCIOL and 98% in MSICS.

Table 7
Status of cornea at discharge according to type of surgery

Complications	Type of surgery Conventional ECCE with PCIOL		MSICS		Total	
	No.	%	No.	%	No.	%
Descemet membrane detachment	0	0	1	2	1	1
Oedema	31	62	24	48	55	55
Clear	19	38	25	50	44	44
Total	50	100	50	100	100	100
Significance	RR=1.28, 95% CI=0.85-1.94, p value=0.23					

Postoperative corneal edema was present in 62% in conventional ECCE with PCIOL and in 48% of MSICS at discharge. The edema was of epithelial type and was located at the superior part of the cornea, the cause of edema being excessive manipulation and retained viscoelastic. Cornea was clear in all eyes at the end of 6-8 weeks. One patient had Descemet membrane detachment in MSICS which was reattached by 6-8 weeks with no obscuration of vision. Anterior chamber reaction was present in mild to moderate intensity in 74% in conventional ECCE with PCIOL and 69% in MSICS at the time of discharge which was well controlled by topical steroid at the end of 6-8 weeks in both types of surgeries. Posterior capsule opacification was present in 4% in conventional ECCE with PCIOL and in 6% in MSICS. But the density of opacification was not significant enough to obscure the vision.

Table 8 (A)
Status of astigmatism after 6-8 weeks according to type of surgery

Conventional ECCE with PCIOL		Astigmatism With the rule	Against the rule	Oblique	Total
0.5-1.0	No.	1	1	2	4
	%	3.7	11.1	16.7	8.3
1.0-1.5	No.	3	3	1	7

	%	11.1	33.3	8.3	14.6
1.5-2.0	No.	1	1		2
	%	3.7	11.1		4.2
2.0-2.5	No.	2	1		3
	%	7.4	11.1		6.3
2.5-3.0	No.	1	2	1	4
	%	3.7	22.5	8.3	8.3
=/>3.0	No.	19	1	8	28
	%	70.4	11.1	66.7	58.3
Total	No.	27	9	12	48
	%	100	100	100	100

Table 8 (B)
Status of astigmatism after 6-8 weeks according to type of surgery

Manual Small-Incision Cataract surgery		With the rule	Astigmatism Against the rule	Oblique	Total
0.5-1.0	No.	1	6	1	8
	%	25	19.4	7.7	16.7
1.0-1.5	No.	2	5	1	8
	%	50	16.1	7.7	16.7
1.5-2.0	No.	1	11	3	15
	%	25	35.5	23.1	31.3
2.0-2.5	No.		4	2	6
	%		12.9	15.4	12.5
2.5-3.0	No.		1	4	5
	%		3.2	30.8	10.4
=/>3.0	No.		4	2	6
	%		12.9	15.4	12.5
Total	No.	4	31	13	48
	%	100	100	100	100

Regarding the type of astigmatism, with the rule astigmatism was present in 54% of conventional ECCE with PCIOL implantation and in 8% of MSICS. Against the rule astigmatism was present in 18% of conventional ECCE with PCIOL and in 62% of MSICS. Oblique astigmatism was present in 16% of conventional ECCE with PCIOL implantation and in 26% of MSICS. The amount of astigmatism was > 3 D in 56% of conventional ECCE with PCIOL implantation and in 12% of MSICS. Overall, the majority of the eyes after MSICS after 6 weeks had less than 2 D of astigmatism (RR=2.28, 95% CI=1.39 - 3.73, p=0.0002).

Discussion

In this study, a postoperative complication seen was corneal oedema which was present in 62% cases in conventional ECCE with PCIOL implantation and 48% in MSICS. Iritis was present in 74% in conventional ECCE with PCIOL implantation and 69% in MSICS. One patient had Descemet membrane detachment in MSICS. Posterior capsule opacification was present in 4% patients in conventional ECCE with PCIOL and in 6% in MSICS.

In the study by Gogate et al (2003), iritis, Descemet's folds and posterior capsule opacification were the commonest postoperative complications. Pham et al (1995) reported iris prolapse, wound dehiscence and hyphema at a rate of 2%. Uusitalo & Tarkkanen, (1998) reported 3.7% of posterior capsule opacification. Balent et al (2001) reported the major post-operative complications as captured iris, hyphema, iris prolapse and corneal oedema. PCO was present in 5.5%. These results suggest that both types of surgeries are safe and reliable.

There is a difference between the two groups for uncorrected visual acuity in the present study. The uncorrected visual acuity of 6/18 or better was 14% in conventional ECCE with PCIOL implantation and 48% in MSICS. Best-corrected visual acuity of 6/18 or better was found in 90% after conventional ECCE with PCIOL and 98% in MSCIS. This result was compared with the study done by Hennig et al (2003) in which they reported uncorrected visual acuity of 6/18 or better in 76.8% at discharge and 70.5% at 6 weeks. Corrected visual acuity of 6/18 or better was found in 96.2% at 6 weeks. The poor uncorrected visual outcome of <6/60 was seen in <2% cases. The main cause was high against the rule astigmatism (Hennig et al 2003).

Gogate et al (2003) in a study of 706 eyes reported uncorrected visual acuity of 6/18 or better at 6 weeks in 37.3% and 47.9% in conventional ECCE with PCIOL and MSICS respectively, which is slightly more in the present study. Post-operative visual acuity of 6/18 or better after retinoscopic refraction was found in 86.7% and 89.6% in conventional ECCE with PCIOL and MSICS respectively (Levy, 1994). The result is better

in the present study. In the review of 362 consecutive sutureless cataract surgeries by Ruit et al (2000), uncorrected visual acuity of 6/18 or better after 2 months was found in 87%.

In a study of 90 patients done by Sood et al (2002), the uncorrected visual acuity was 6/6 in 36.6% in conventional ECCE with PCIOL and 40% in MSICS. This result is slightly better in the present study. Balent et al (2001) reported corrected visual acuity of 6/6 to 6/18 in 38% in conventional ECCE with PCIOL, whereas 60.10% attained visual acuity of 6/24 or better in MSICS (Balent, 2001), which is less than that of the present study. Studies of the outcome of cataract extraction in Asia have shown that presenting acuity following surgery is < 6/60 in 15- 20% of eyes. Most of the poor outcomes are due to uncorrected refractive error and postoperative astigmatism.

Regarding the type of astigmatism, with the rule astigmatism was present in 54% of conventional ECCE with PCIOL implantation and in 8% of MSICS. Against the rule astigmatism was present in 18% of conventional ECCE with PCIOL and in 62% of MSICS. Oblique astigmatism was present in 16% of conventional ECCE with PCIOL implantation and in 26% of MSICS. The amount of astigmatism was > 3 D in 56% of conventional ECCE with PCIOL implantation and in 12% of MSICS. The cylinder > 3D was found in 56% in conventional ECCE with PCIOL whereas in MSICS, it was 12%. The against the rule astigmatism was more in MSICS whereas the amount of cylinder was more in conventional ECCE with PCIOL.

Sood et al (2002) reported the pattern of astigmatism as WTR astigmatism in 72.2% and ATR astigmatism in 20% in conventional ECCE with PCIOL implantation, and WTR astigmatism in 40.2% and against the rule astigmatism in 40% in MSICS which is comparable with our study. Levy et al (1994) stated that there is a tendency towards against the rule astigmatism induced cylinder throughout the postoperative period. According to Olsen et al (1997), in the scleral incision groups, the induced astigmatism decreased slightly after 1 week and after that no significant change was detected. Feil et al (1994), in their study of 22 patients, reported that there was little change in cylinder from 1 week to 1 month in self-sealing incisions.
In the study of Pandey et al (2000), the astigmatism was < 1D in 71.7% at 6 weeks in self-sealing corneal incision and was >1D in conventional ECCE with PCIOL. Change in corneal curvature after an incision is continuous until the wound stabilizes. Merrian et al (2003) reported that the average behaviour of the cornea after cataract surgery is predictable and provides models that describe change on the horizontal and vertical meridians as a function of time. Incisions on the superior meridian lead to an immediate steeping of the vertical meridian and flattening of the horizontal meridian followed by a gradual flattening of the vertical meridian and steeping of the horizontal meridian. The follow-up of the patients was longer for the large-incision group than for the small-incision group.

Conclusion

The uncorrected visual acuity is better after MSICS at the time of discharge and also at 6-8 weeks, showing that the visual recovery is faster in MSICS than in conventional ECCE with PCIOL implantation.

The cause of poor visual outcome after cataract surgery is astigmatism. With the rule astigmatism is more in conventional ECCE with PCIOL implantation than in MSICS and against the rule astigmatism is more in MSICS than in conventional ECCE with PCIOL.

As a large proportion of patients do not wear their postoperative refractive corrections, MSICS is recommended as the procedure of choice for effective rehabilitation of cataract patients. It can, therefore, be recommended that the upcoming ophthalmologists be trained in MSICS.

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