A COMPARATIVE STUDY OF THE AMOUNT OF ASTIGMATISM FOLLOWING CONVENTIONAL EXTRACAPSULAR CATARACT EXTRACTION AND MANUAL SMALL INCISION CATARACT SURGERY

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ABSTRACT

BACKGROUND

Cataract is the principal cause of avoidable blindness in India and throughout the world. Surgical removal of the cataractous lens remains the only effective treatment for management of cataract blindness. The success of cataract surgery is determined by best and earliest visual recovery. But the occurrence of postoperative astigmatism has become a major hurdle in achieving this goal.

AIMS

The study was designed to compare the amount of astigmatism following conventional extracapsular cataract extraction (ECCE) and manual small incision cataract surgery (SICS).

MATERIALS AND METHODS

The study was carried out in 100 eyes of 75 patients aged between 50 and 80 years admitted for cataract surgery. Out of these, 50 eyes were operated by conventional extracapsular cataract extraction and 50 eyes by manual small incision cataract surgery. The patients were followed up at 2nd, 4th, 6th and 8th weeks. At each follow-up visual acuity, refraction and acceptance and keratometry were recorded and the findings analysed for astigmatism.

RESULTS

In the current study, the mean (SD) astigmatism developed at the end of the 2nd, 4th and 6th of follow-up was significantly lower in the SICS group as compared to the ECCE group (P<0.000). At the end of 8 weeks of follow-up, the mean (SD) astigmatism of the SICS group was 0.64±0.56 D as compared to the mean (SD) of the ECCE group of 1.39±86 D and the difference was found to be significant (p<0.014).

CONCLUSION

The current study concludes that manual small incision cataract surgery is a better technique to control postoperative astigmatism than conventional extracapsular cataract extraction.

KEYWORDS

Cataract, Extracapsular Cataract Extraction, Small Incision Cataract Surgery, Astigmatism.

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INTRODUCTION: Cataract is the principal cause of avoidable blindness in India and throughout the world. There is an estimated incidence of 2 million cataract induced blindness in India. Cataract is responsible for 62.6% of all blindness in India, according to 2001-02 National survey on Blindness.[1] Surgical removal of the cataractous lens remains the only effective treatment for management of cataract blindness. The fundamental aim of cataract surgery is removal of the opacified natural lens and replacing it with an artificial intraocular lens to improve vision.

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There are different techniques of cataract surgeries like conventional extracapsular cataract extraction (ECCE), small incision cataract surgery (SICS) and phacoemulsification.[2] In conventional ECCE, major portion of anterior capsule, epithelium, nucleus and cortex of lens are removed leaving behind posterior capsule through a large incision at the limbus which is then sutured after implantation of intraocular lens. Closure of incision is done by five interrupted sutures with 10-0 monofilament polyamide. In SICS, extracapsular cataract extraction with intraocular lens implantation is performed through a self-sealing valvular sclerocorneal tunnel incision. In phacoemulsification, the nucleus is emulsified and aspirated by a phacoemulsifier. The success of cataract surgery is determined by best and earliest visual recovery. The visual outcome depends mainly on the amount of post-operative astigmatism[3] which is a type of

refractive error wherein the refraction varies in different meridian. Consequently, the rays of light entering the eye cannot converge to a point focus but form focal lines and the condition cause blurred vision. With the rule (WTR) astigmatism is a type of Regular astigmatism where the vertical meridian is steepest, Against the rule (ATR) astigmatism when the horizontal meridian is steepest and Oblique astigmatism when the principal meridian are perpendicular but not in vertical or horizontal axis. The postoperative astigmatism depends upon the size, site and type of incision. The occurrence of postoperative astigmatism has become a major hurdle in achieving best and earliest visual recovery. Nowadays, all techniques of cataract extraction are being modified to give best uncorrected visual acuity and early rehabilitation. In recognition of this, there is a strong advocacy of small incision cataract surgery either manually or by phacoemulsification. However, cost, both in terms of equipment and training, has limited the use of phacoemulsification in the developing world. Conventional ECCE has problems related to wound suturing with its associated complications and late visual rehabilitation [4]. Manual small incision cataract surgery is claimed to be an inexpensive alternative to phacoemulsification. It has the advantages of small, self-sealing sutureless incision, non-phacosurgery technique which is machine independent, less time consuming, faster rehabilitation, less astigmatism, better post-operative vision and is cost-effective [5]. A study is necessary to find out the best technique of cataract surgery to address the backlog of cataract blindness in our part of the developing world.

AIMS AND OBJECTIVES: The study was designed to compare the amount of astigmatism following conventional extra capsular cataract extraction (ECCE) and manual small incision cataract surgery (SICS).

MATERIALS AND METHODS: The study was conducted in the Department of Ophthalmology on patients aged between 50 to 80 years. Approval of the Institutional Ethical Committee was obtained before the study was conducted. A total of 75 patients participated in the study. Informed consent was taken from each patient before surgery about the study.

Inclusion Criteria: All patients with uncomplicated cataract undergoing cataract surgery by convention ECCE or manual SICS during the study period and consented to participate in the study.

Exclusion Criteria: 1) Patients with any intraoperative complication rendering them aphakic 2) Pre-existing high astigmatism 3) Patients with corneal scarring.

Patients were divided into two groups – Group A, those patients who underwent conventional ECCE and Group B, those who underwent manual SICS. Out of the 75 patients, 50 eyes were operated by conventional ECCE (Group A) and 50 eyes by manual SICS (Group B). An adequate mydriasis was obtained with Tropicamide 0.8% and Phenylephrine 5%. All cataract surgeries were performed under local anaesthesia by peribulbar injection of a mixture of 2% Lignocaine and Hyaluronidase in the concentration of 1.2 units/mL. In conventional ECCE, superior rectus bridle suture was passed to fix the eyeball in downward gaze. Fornix based conjunctival flap was raised superiorly and bleeding points cauterised. A partial thickness corneoscleral incision was made from 10 to 2 o'clock position superiorly. A side port was made at 11 o'clock position and Trypan blue (0.1 mL of 0.06%) was injected into anterior chamber to stain the anterior capsule. Capsulotomy was done after maintaining anterior chamber depth with viscoelastic substance. Corneoscleral section was completed, hydrodissection done and nucleus removed by tumbling technique. The remaining cortical matter was washed by Simcoe cannula and a 6 mm posterior chamber intraocular lens was implanted in the capsular bag. Closure of the incision was done by five interrupted sutures with 10-0 monofilament polyamide. Conjunctival flap was re-apposed and cautery applied at the end. Subconjunctival injection of antibiotic and steroid was given. In SICS, a partial thickness 6.5 mm long frown incision was given 2 mm posterior to the limbus superiorly. Scleral tunnel was created, side port made at 9 o'clock position and capsule was stained with Trypan blue dye. A 2.8 mm keratome was used to access the anterior chamber and capsulotomy was performed under cover of viscoelastic substance. Hydrodissection and hydrodelineation was done, and lens was brought to anterior chamber with a Sinskey hook and delivered with the help of an irrigating Vectis. The remaining cortical matter was washed with Simcoe cannula and a 6 mm PCIOL implanted in the capsular bag. Viscoelastic substance was replaced with balanced salt solution and side port was hydrated to maintain the anterior chamber. Conjunctival flap was re-apposed and cauterised and subconjunctival injection of antibiotic and steroid was given. The patients were followed up at 2nd, 4th, 6th and 8th weeks postoperatively. At each follow-up, the following were recorded: - (1) Visual acuity (2) Refraction and acceptance and (3) Keratometry. Visual acuity is measured by the smallest object which can be clearly seen at a certain distance. It is recorded by Snellen's test-type for literate patient and Landolt's ring or E-chart for illiterate patients. Refraction is the method of evaluating the optical state of the eye and is measured by Retinoscopy, Trial and error, Pinhole test, fogging and near vision correction. Keratometry is the measurement of curvature of the anterior surface of cornea across a fixed chord length, usually 2-3 mm, which lies in the optical zone of the cornea. Keratometry is performed using Bausch and Lomb keratometer. During the study for detection of postoperative astigmatism, the same keratometer was used by the same person for the same patient at each follow-up. The amounts of induced astigmatism were calculated and the results were analysed by appropriate statistical methods.

RESULTS AND OBSERVATION: A total of 60 (60%) patients had preoperative astigmatism of With the Rule type (WTR), 23(23%) had Against the Rule (ATR) astigmatism preoperatively and 17(17%) had none.

Mean preoperative astigmatism (SD) of ATR type was 0.521±0.625 and mean preoperative astigmatism (SD) of WTR type was 0.520±0.472.

At the 4th (last) follow-up, 40 patients had WTR astigmatism, 53 had ATR and 7 patients had none. Group wise in the ECCE group 36 patients had WTR, 12 ATR and 1 had no astigmatism. In the SICS group, 4 patients had WTR, 12 had ATR and 6 had no astigmatism.

The preoperative astigmatism among all the patients who underwent cataract surgery was 0.543±0.572 and postoperative astigmatism was 1.0522±0.816. The difference was found to be statistically significant (Table 1). At the 2nd, 4th, 6th and 8th week of follow-up, the mean postoperative astigmatism in the SICS group was found to be significantly lower (p<0.000) as compared to the mean postoperative astigmatism in the ECCE group. (Table 2).

Astigmatism	Mean (SD)	Paired difference Mean (SD)	t	p-value
Preoperative	0.543± 0.572	-0.478± 0.657	-7.25	0.000
Last follow-up	1.022± 0.819			

Table 1: Comparison of Pre and Postoperative Astigmatism

Follow up (Weeks)	Proce-dure	Mean (SD) Astigmatism	Mean differ-ence	t	p-value
2nd	ECCE	3.48±1.7	1.710	6.12	0.000
	SICS	1.77 ±0.9			
4th	ECCE	2.51±1.26	1.145	5.376	0.000
	SICS	1.36±0.82			
6th	ECCE	1.84±0.91	0.850	5.374	0.016
	SICS	0.98±0.63			
8th	ECCE	1.39±0.86	0.742	5.060	0.014
	SICS	0.64±0.56			

Table 2: Comparison of Postoperative Astigmatism at 2nd, 4th, 6th and 8th week between the two Groups

DISCUSSION: Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. The major determinants of astigmatism are the site and size of incision, the type of suture used and the suturing technique. Since postoperative astigmatism is the major determinant of visual outcome, a comparative study is essential to ascertain the difference in induced astigmatism, if any, for Conventional Extracapsular Cataract Extraction versus Manual Small Incision Cataract Surgery.

This study shows a statistically significant difference in the amount of induced astigmatism between the two types of surgery, highlighting that Manual Small Incision Cataract Surgery is highly effective in controlling postoperative astigmatism.

The pattern of preoperative astigmatism was WTR in 60% of cases, ATR in 23% and 17% had no astigmatism.

The mean (SD) preoperative astigmatism type of WTR type was 0.520 D (0.472) and ATR type in 0.521 D (0.625).

Duke-Elder[6] mentioned a preoperative WTR astigmatism of 0.25 D which is accepted as physiological. It is presumably due to the constant pressure of the upper lid upon the eye.

At the first follow-up (2 weeks) in the present study, the mean (SD) postoperative astigmatism was 3.48±1.7 D in the ECCE group and 1.77±0.9 D in the SICS group. This finding is comparable to the finding of Zheng L et al[7] of postoperative astigmatism after 2 weeks of +3.47 D in the ECCE group and +1.23 D in the 6 mm small superior incision by phacoemulsification group and also to that of Naus NC et al.[8] They found postoperative astigmatism on day 10 of 3.607 D in ECCE group and 1.636 in small incision by phacoemulsification group.

In the present study at the second follow-up (4 weeks), the mean (SD) postoperative astigmatism was 2.51±1.26 D in the ECCE group and 1.36±0.82 D in the SICS group. Talamo JH et al[9] who found surgically induced 1.44 D of with-the-rule astigmatism at one month in cases of ECCE. Lim TS et al[10] observed mean postoperative astigmatism at 1 month of 2.92–6.57 D in eyes operated through corneal incision and 1.96 D in those operated through scleral incision in ECCE. He Y et al[11] found a mean keratometric corneal astigmatism at 1 month postoperative of 1.09±1.03 dioptre in cases operated by superior scleral tunnel incision phacoemulsification. The results of these studies are comparatively similar to the present study.

At the third follow-up (6 weeks), the mean (SD) postoperative astigmatism was 1.84±0.91 D in the ECCE group and 0.98±0.63 D in the SICS group. The results are comparable to the study of Sood A et al[12] who observed a postoperative astigmatism at 6 weeks of 1.46±0.83 D for patients operated by manual SICS and 2.46±1.98 D for Conventional Large Incision Cataract Surgery. Hennig A et al[13] found 6 weeks after manual SICS an against-the-rule astigmatism of 1.41 D (SD 0.8). These findings are comparatively similar to the present study.

At the fourth follow-up (8 weeks), the mean (SD) postoperative astigmatism was 1.39±0.86 D in the ECCE group and 0.64±0.56 D in the SICS group in the present study. These are comparable to findings of Yorston D et al[14] of average astigmatism at 2 months of 1.50 D (SD 1.48) in the ECCE group and also to the findings of Ahmad I et al[15] who showed a postoperative astigmatism of 0.69 D 12 weeks after SICS.

CONCLUSION: The present study shows that the postoperative astigmatism was significantly higher than the preoperative astigmatism showing that astigmatism is an unwanted side effect of cataract surgery. The postoperative astigmatism was significantly higher in the ECCE group compared to the SICS group in all the follow-ups showing that manual SICS produces better results to control postoperative astigmatism. Thus, it is concluded that manual

small incision cataract surgery is the better technique to tackle the backlog of cataract blindness in the developing world.

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