Cataract Blindness in Developing Countries — Procedure of Choice for a Large Population

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Purpose: *A study was performed to compare the merits of phacoemulsification with non-phacoemulsification small incision cataract surgery. Additionally, the use of 5.5 mm non-foldable intraocular lenses was compared with foldable intraocular lenses. The cost-effectiveness of these procedures was evaluated.*
Patients and Methods: *750 patients were enrolled in the study. Phacoemulsification with foldable intraocular lenses was performed for 250 patients (group A). Non-foldable phacoprofile intraocular lenses after phacoemulsification were implanted for 250 patients (group B). 250 patients had non-phacoemulsification small incision cataract surgery using phacoprofile non-foldable intraocular lenses (group C). The incision site and extent were similar for all patients. Non-phacoemulsification small incision cataract surgery was performed by a modified phacofracture technique.*
Results: *Postoperative complications and visual rehabilitation were comparable for patients in all 3 groups.*
Conclusion: *The non-phacoemulsification small incision cataract surgery technique with a phacoprofile non-foldable lens is feasible as the procedure of choice for a large population in a developing country.*

Key words: Lenses, intraocular, Ophthalmologic surgical procedures, Phacoemulsification, Comparative study, Cost-benefit analysis

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Introduction

Cataract blindness is one of the major community health problems in India. Cataract surgery and intraocular lens (IOL) implantation restores vision to near normal. Safe surgery, early visual rehabilitation, and postoperative emmetropia are the requirements for present day cataract surgery.[1,2] Phacoemulsification meets most of these needs. In a developing country such as India, with few resources, the procedure of choice should be one that has the merits of phacoemulsification but with a lower cost and fewer complications.

This study was therefore undertaken for the following reasons:

- to present an alternate technique of non-phacoemulsification small incision cataract surgery (SICS)
- to compare the merits of phacoemulsification with non-phacoemulsification SICS
- to evaluate the use of non-foldable IOLs with an optic diameter of 5.5 mm as an alternative to the costlier foldable IOLs
- to compare the cost of surgery for phacoemulsification with or without foldable lenses and non-phacoemulsification SICS with non-foldable rigid lenses.

Patients and Methods

750 patients with cataract of varying degrees of hardness of the lens nucleus, except grade IV, in otherwise healthy eyes were enrolled in the study after evaluation. All patients gave informed consent. The operations were performed using peribulbar anaesthesia.

Central curvilinear capsulorhexis (CCC) was performed in all eyes with a 26-gauge needle made into a cystitome. After performing CCC of approximately 4 mm, an external scleral incision with the base at the limbus was made. Hydrodissection and hydrodelineation procedures were performed. Patients were randomly assigned to phacoemulsification with foldable IOL (group A, n = 250), phacoemulsification with phacoprofile non-foldable IOL (group B, n = 250), and non-phacoemulsification SICS with phacoprofile non-foldable IOL (group C, n = 250).

For patients in groups A and B, phacoemulsification was performed with the venturi system, mostly by the divide and conquer technique. For patients in group C, the lens nucleus was manually divided in the capsular bag by modified Mcpherson forceps, which is an ordinary Mcpherson forceps with a wedge-shaped elevation on 1 of the blades which fits into a groove provided on other blade. The lower blade was introduced between the posterior lens

surface and the posterior capsule in a bath of viscoelastic and the upper blade was placed over the anterior surface of the lens. Simply closing the jaws divided almost all of the nuclei except for the hardest (grade IV). The nuclear fragments were rotated through 90° and the pieces were vertically divided in a similar fashion.

The smaller nuclear pieces were removed with expression of the viscoelastic or with microintracapsular forceps. Phacoprofile non-foldable IOLs with an optic diameter of 5.5 mm and a haptic diameter of 12.0 mm were inserted into the capsular bag in patients in groups B and C, whereas foldable IOLs with an optic diameter of 6 mm and a haptic diameter of 13 mm were inserted into the capsular bag using an inserter in patients in group A.

Results

427 patients were male and 323 were female, aged between 45 and 65 years. Postoperatively, the patients were not restricted in mobility or diet. The patients were followed up after 1, 2, 3, and 6 weeks. They were evaluated for early visual rehabilitation, astigmatism, subjective discomfort, and other associated complications. The visual acuity was evaluated as shown in Table 1. Complications were comparable for patients in all 3 groups.

The optical correction in group A ranged between -0.5 D cylindrical axis 90° to -1.0 D cylindrical axis 90°, whereas the optical correction of the eyes ranged between 0.5 D spherical correction per -0.75 D cylindrical axis 90° to 0.5 D spherical correction per -1.25 D cylindrical axis 90° for patients in group B and -0.75 to -1.25 D cylindrical axis 90° for patients in group C.

The cost incurred for all the procedures was determined and compared between the 3 groups as shown in Table 2. The cost of phacoemulsification with foldable IOL was approximately 3-fold more than non-phacoemulsification SICS with phacoprofile non-foldable IOL, whereas the cost of phacoemulsification with phacoprofile rigid IOL was 2-fold that of non-phacoemulsification SICS with phacoprofile rigid IOL.

Table 1. Postoperative unaided visual acuity.

	Group A	Group B	Group C
Week 1			
6/6 - 6/9	193	125	108
6/12 - 6/18	36	87	71
6/24 - 6/60	21	33	63
<6/60	—	5	8
Week 2			
6/6 - 6/9	215	142	150
6/12 - 6/18	28	76	71
6/24 - 6/60	7	32	29
<6/60	—	—	—
Week 3			
6/6 - 6/9	229	192	196
6/12 - 6/18	21	54	54
6/24 - 6/60	—	4	—
<6/60	—	—	—
Week 6			
6/6 - 6/9	229	204	200
6/12 - 6/18	21	46	50
6/24 - 6/60	—	—	—
<6/60	—	—	—

Discussion

A procedure of choice for cataract extraction for a large population should have the following features:

- cheap and easily affordable by the population in developing countries
- rehabilitation should be early to avoid economic loss
- postoperative visual status should be near emmetropic
- complications should be minimal
- complications associated with suturing should be minimised.

Phacoemulsification has a good reputation because of early visual rehabilitation. However, to cut the cost associated with phacoemulsification, non-phacoemulsification SICS became popular. Non-phacoemulsification SICS is therefore a suitable alternative approach to phacoemulsification. Various techniques have been described for nuclear management in non-phacoemulsification SICS.[3-6] The technique of phacofracture with modified Mcpherson forceps is simple and easy to learn and is devoid of complications associated with the high energy used in phacoemulsification but has all the merits of phacoemulsification. Although suprahard nuclei can also be broken by this technique, they have not been included in this study.

Cataract is the leading cause of blindness worldwide, accounting for half of the world's 40 million blind people.[7,8] There are approximately 12 million people who are blind in India. Of these, 8 million people are blind due to cataract, with an annual incidence of 2 million.[9,10] 1.6 million cataract operations are performed every year, but cataract blindness is increasing at a faster rate.

The total cost of cataract surgery depends on pre- and perioperative medicines, anaesthetic agents, viscoelastic and other

Table 2. Cost of different surgical techniques (Indian rupees).

	Group A	Group B	Group C
Preoperative medicines (antibiotics, mydriatics, etc)	60	60	60
Operative materials			
Anaesthetics	100	100	100
Viscoelastics and other materials	200	200	200
Disposables	400	400	400
Instrumentation (per patient)*	2000	2000	—
Intraocular lens	3500	1500	1500
Total	**7760**	**4260**	**2260**

* To calculate the cost per patient of the phacoemulsification instrumentation the cost of the phacoemulsification machine was divided by the number of patients who underwent phacoemulsification surgery. In addition, the cost of replaceable items (sleeves, phacoemulsification tips, compressed air, etc) was similarly calculated by dividing the cost by the number of patients requiring each item.

materials, disposables including keratomes, instrumentation, and IOLs. For an initial 500 phacoemulsification operations, the additional cost of each operation for the phacomachine and replaceable items is approximately Rs2000. The cost incurred for patients in all 3 groups in this study is shown in Table 2. It is clear from the Table that the cost of IOL implantation with non-phacoemulsification SICS using rigid lenses is cheaper than using phacoemulsification with or without foldable lenses. If the 2 million new cases of blindness were operated annually by any of the 3 procedures described in this paper, all of which provide early visual rehabilitation, the total cost would be Rs452 crore (US$94.2 million) for non-phacoemulsification SICS with phacoprofile rigid lenses, Rs852 crore (US$177.5 million) for phacoemulsification with phacoprofile rigid lenses, and Rs1552 crore (US$323.3 million) for phacoemulsification with foldable lenses.

With the expense of the phacoemulsification technique, it is clear that non-phacoemulsification SICS should be the procedure of choice for tackling cataract blindness among large populations in developing countries since it provides all the merits of phacoemulsification at a lower cost. Phacoemulsification with its steep learning curve and greater complications can, at best, be the procedure of choice only for high socioeconomic groups.

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