Research

Monitoring visual outcome of cataract surgery in India

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Two simple methods of assessing visual outcome following cataract surgery were evaluated in India. The first used data obtained from standardized patient records of cataract surgery. The second used data from population-based rapid epidemiological assessments. Analysis of 4168 hospital and eye camp records showed that, with the available standard correction, a good outcome (visual acuity $\geqslant$ 6/18) was achieved in 37.8%, a borderline outcome (visual acuity 6/24–6/60) in 45.6% and a poor outcome (visual acuity 6/60) in 16.6% of instances. Of 2401 aphakic/pseudophakic eyes examined in a cross-sectional population-based study, outcome was good in 43.5% and poor in 26.4%. For 776 eyes examined in a similar study in a different state, outcome was good in 49.9% and poor in 23.9%. These assessments indicate that outcome with available correction was poor in 15–25% of eyes following cataract surgery. Visual outcome is likely to improve when better correction for aphakia can be provided. Further assessment of the causes of poor visual outcome is needed. The visual outcome following cataract surgery could be monitored on a regular basis by ophthalmologists, using either of the methods evaluated, an exercise which in itself is likely to improve the outcome of surgery. When the proportion of poor outcomes is high (>10%) further investigation into the causes is warranted.

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Introduction

Cataract is the major cause of blindness and of severe visual impairment in many developing countries, leading to bilateral blindness in an estimated 20 million people worldwide. The latest available national data on cataract blindness in India date from 1989 (*1*). By projecting prevalence data, we estimated that in 1997 there were 5.4 million persons who were bilaterally blind (visual acuity <3/60) and 11.5 million with bilateral severe visual impairment (visual acuity <6/60) from cataract throughout the country.

The performance of cataract intervention programmes is assessed by the number of cataract operations conducted each year. In India, this number has increased from 1.2 million in 1989 to 2.7 million in 1996 (Central Ophthalmic Cell, Directorate General Health Services, Government of India, unpublished data, 1997). The crude cataract surgical rate (CSR) can be estimated using the total population as denominator; age-specific rates can also be calculated if population and surgery data are available for defined age groups (*2*). For India, the CSR in 1996 was approximately 2800 per million of the total population.

Cataract surgery aims to rehabilitate blind or visually impaired persons by restoring their eyesight so that their quality of life and ability to function are returned to normal or as near normal as possible. The outcome of cataract surgery for an individual or for a defined population is therefore as important as measuring the quantity of surgical operations performed. Outcome can be measured simply as the visual acuity in the operated eye or in the patient (*3*), and also in terms of ability to function, quality of life (*4, 5*), and economic rehabilitation (*6*). The last three of these parameters can only be assessed through time-consuming studies and fall outside the scope of this article.

Here we describe the evaluation of two simple methods for determining visual outcome following cataract surgery, which might be used by ophthalmologists and programme managers to monitor the quality of cataract surgery services.

Materials and methods

The first method consisted of examining the records of patients who had undergone cataract surgery.

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Following field trials in several districts of India, a standardized cataract surgical record was introduced in April 1996 by the National Programme for Control of Blindness to record the age, sex, pre- and postoperative visual acuity for each eye with provided correction, place and type of surgery and complications.[a] The postoperative visual acuity is to be measured 4–6 weeks after the surgery. Data from such records from several districts in the states of Gujarat, Karnataka and Maharashtra were collected and analysed. The data were not collected by a randomized method and therefore may not be representative.

Measures of outcome were classified as "good", "borderline" or "poor". "Good outcome" was defined as a visual acuity of $\geqslant 6/18$ with the available correction; "borderline outcome" as 6/24–6/60; and "poor outcome" as <6/60. Using patients' records it was possible to calculate the proportion of cataract operations that had resulted in sight restoration in bilaterally blind (or severely visually impaired) persons. This sight restoration rate (*SRR*) is a measure of the efficiency of a programme in reducing the prevalence of cataract blindness and is given by the following expression:

$$SRR = \frac{P\,(\text{pre}) - P\,(\text{post})}{C} \times 100$$

where

P (pre) = number of persons with the specified preoperative visual acuity in the better eye (e.g. <3/60);

P (post) = number of persons with the specified postoperative visual acuity in the better eye (e.g. <3/60); and

C = total number of cataract operations evaluated in the period.

The second method involved a population-based assessment in which a random sample of the population was examined and the visual acuity of those who had undergone cataract operations was measured. In 1995, rapid assessments were conducted in 19 of the 20 districts in Karnataka State (the urban district of Bangalore was not included) to estimate the prevalence of severe visual impairment and blindness of cataract, the prevalence of aphakia, the cataract surgical coverage, and the barriers preventing patients from receiving cataract surgical services. A similar rapid assessment was undertaken in Ahmedabad district, Gujarat, in 1997.

Results

Data from a total of 4168 recent cataract surgical record forms were analysed using customized software (written in Epi Info, version 6.04). Of the surgical procedures undertaken, 54% were performed on males, 65% were on one eye, and 57% were carried out in eye camps. The following surgical techniques were used: intracapsular cataract extraction with spectacles (46% of eyes), extracapsular cataract extraction with spectacles (42%), and extracapsular cataract extraction with intraocular lens implantation (11%).

Table 1 shows the preoperative and postoperative visual acuity for the operated eyes. The majority of operations (83.4%) were performed on eyes with a preoperative visual acuity of <3/60. Postoperative outcome was good in 37.8% of eyes, borderline in 45.6%, and poor in 16.6%.

Of the 4168 procedures, 476 (11%) involved an intraocular lens implantation. In this group, the outcome was good in 27.1%, borderline in 49.2%, and poor in 23.7%. For the remaining 3692 eyes, the outcome was good in 39.2%, borderline in 45.1%, and poor in 15.6%. For the 1806 eyes treated in hospitals, the outcome was good in 55.4% and poor in 11.4%; and for the 2362 eyes treated in eye camps, the outcome was good in 24.3% and poor in 20.5% (see Table 2).

Of the 931 persons who were blind prior to surgery, 59 remained so postoperatively, giving a net reduction of 872, and for 4168 procedures an SRR of 21% (Table 3).

The results of the assessment of long-term postoperative visual acuity through population-based surveys in Karnataka and Ahmedabad district of Gujarat are presented in Table 4. Of the 21 950 persons aged $\geqslant 50$ years examined in Karnataka, 1843 (8.4%) had undergone cataract surgery, with a follow-up period of 0–32 years (mean, 6 years) (*7*). In all, 558 persons had bilateral aphakia and 1285 unilateral aphakia, giving a total of 2401 operated eyes. Of these, 123 (5.1%) were pseudophakic. For all operated eyes, outcome was good in 43.5% and poor in 26.4%. For the 2278 aphakic eyes, the outcome was good in 41.4% and poor in 27.2%, with the available correction. For 31% of eyes with a poor outcome, the patients had lost or broken their spectacles. Since best corrected vision was not measured, it is difficult to assess how many cases of poor and borderline outcome might have benefited from full spectacle correction. For the 123 pseudophakic eyes, the outcome was good in 82.1% and poor in 11.4%.

Of the 1962 persons aged $\geqslant 50$ years examined in Ahmedabad district, 484 (24.7%) had undergone cataract surgery, with a follow-up period of 0–30 years (mean, 5.5 years) (Limburg et al., unpublished data, 1999). In all, 292 persons had bilateral aphakia and 192 unilateral aphakia, giving a total of 776 operated eyes. Of these 189 (24%) were pseudophakic. For all operated eyes, outcome was good in 49.9% and poor in 23.9% with the available correction. For the aphakic eyes, outcome was good in 44.2% and poor in 28%; and for the 189 pseudophakic eyes, outcome was good in 67.2% and poor in 11.6%.

[a] Copies of these forms and a special software package to analyse the data they record are available from Danish Assistance to the National Programme for Control of Blindness, A1/148, Safdarjung Enclave, New Delhi 110 029, India (fax: +91 11 618 1099; e-mail: danpcb@danpcb.org).

Discussion

The two methods for determining the outcome of a cataract surgery service used in the present study measured visual acuity in the operated eye, with the available correction, as the indicator of outcome. The disadvantage of this indicator is that it does not take into account the potential vision in the eye if full correction is given; nor does it take into account vision in the other eye. In fact, the impact of a cataract intervention is best gauged by the change in the patient's quality of life. However, this requires an assessment of how the patient functioned before and after surgery and of the potential for employment and improved income. The advantage of using postoperative visual acuity is that it is simple and inexpensive to determine in all patients. Moreover, it is the indicator that probably matters most to eye surgeons and which the patient immediately recognizes. The terms "good outcome", "borderline outcome" and "poor outcome" can be defined by the eye surgeon or institution concerned but, once defined, should be used consistently to monitor the visual outcome of all eyes undergoing age-related cataract surgery.

The first method we employed uses information which is generally recorded by eye surgeons to evaluate their performance in the early postoperative period 4–6 weeks after surgery, when it should be possible to follow all patients. The results of the present study are summarized in Table 2 and show that outcome was poor in approximately 1 in 6 eyes. The results appear to be worse for operations undertaken in eye camps (20.5%) than for those performed in hospitals (11.4%), but this may be due to patient selection. Outcome was poor in a higher proportion of eyes implanted with an intraocular lens (23.7%) than in those with spectacles (15.6%). This may reflect difficulties during the transition in surgical technique from intracapsular to extracapsular intraocular lens implantation, since only 11% of the procedures involved implantation.

The second method that we used provides population-based data on the results of cataract surgery obtained from a random sample of the target population using a rapid epidemiological assessment (*8*). The method is not specific to one surgeon or hospital and the follow-up period covered both persons who underwent operations a long time previously and those who had surgery recently. New trends are therefore diluted by old practices, and the results of all service providers are represented, not just those of the individual surgeon or institution.

The results of the present study are summarized in Table 2 and show that the outcomes in Karnataka and Ahmedabad district of Gujarat are similar; overall, outcome was poor in approximately 1 in 4 eyes (26.4% and 23.9%, respectively). In both these states the eyes with intraocular lens implantation did better (poor outcome in 11.4% and 11.6%, respectively) than those with aphakic spectacles (27.2% and 28%, respectively). This difference was in part due to lost and broken aphakic spectacles which had not been replaced.

The proportion of eyes having a poor outcome following cataract surgery (postoperative visual acuity <6/60) could be used as an indicator to monitor outcome on a regular basis. The lowest proportions of poor outcome with available correction reported in developing countries are in the range 3–5% (*3*). The proportion of poor outcome that we found in our study of 5–10% (*6*) probably indicates that there is scope for improvement; results indicating that >10% (*9, 10*) of procedures have a poor

Table 1. **Visual acuity before and after cataract surgery for eyes in the study population**

Visual acuity	No. preoperative		No. postoperative	
6/6–6/18	3	(0.1)[a]	1 575	(37.8)[b]
6/24–6/60	78	(1.9)	1 900	(45.6)[c]
<6/60–3/60	612	(14.6)	538	(12.9)[d]
<3/60	3 475	(83.4)	155	(3.7)[d]
Total	**4 168**	**(100.0)**	**4 168**	**(100.0)**

[a] Figures in parentheses are percentages.

[b] Good outcome.

[c] Borderline outcome.

[d] Poor outcome.

Table 2. **The proportion of cataract operations with a poor visual outcome (visual acuity <6/60), by place and type of surgery**

Period of follow-up[a]	Total no. of eyes	% poor outcome
Short-term (4–6 weeks)		
All eyes	4 168	16.6
Camps	2 362	20.5
ICCE + specs	1 441	9.9
ICCE + AC-IOL	6	33.3
ECCE + specs	722	38.5
ECCE + PC-IOL	188	31.4
Hospitals	1 806	11.4
ICCE + specs	482	2.9
ICCE + AC-IOL	10	0
ECCE + specs	1 040	13.5
ECCE + PC-IOL	272	19.2
IOLs	476	23.7
Others	3 692	15.6
Long-term (mean, 5–6 years)		
Karnataka		
All eyes	2 401	26.4
IOLs	123	11.4
Others	2 278	27.2
Ahmedabad		
All eyes	776	23.9
IOLs	189	11.6
Others	587	28.0

[a] AC = anterior chamber; ECCE = extracapsular cataract extraction; ICCE = intracapsular cataract extraction; IOL = intraocular lens; PC = posterior chamber; specs = spectacles.

Table 3. **Pre- and postoperative visual acuity in the better eye of persons undergoing cataract surgery**

Visual acuity	No. preoperative		No. postoperative	
6/6–6/18	523	(12.5)[a, b]	1 691	(40.6)
6/24–6/60	1 691	(40.6)	2 154	(51.7)
<6/60–3/60	1 023	(24.5)	264	(6.3)
<3/60	931	(22.4)	59	(1.4)
Total	**4 168**	**(100.0)**	**4 168**	**(100.0)**

[a] Figures in parentheses are percentages.

[b] Sight restoration rate: for pre- and postoperative visual acuity of <3/60, 20.9%; for pre- and postoperative visual acuity of <6/60, 39.1%.

Table 4. **Visual outcome for aphakic/pseudophakic eyes following cataract surgery by rapid assessments in 19 districts of Karnataka and the Ahmedabad district of Gujarat, India**

Visual acuity	No. in Karnataka		No. in Ahmedabad	
6/6–6/18	1 045	(43.5)[a]	387	(49.9)
6/24–6/60	722	(30.1)	203	(26.2)
<6/60–3/60	214	(8.9)	70	(9.0)
<3/60	420	(17.5)	116	(14.9)
Total	**2 401**	**(100.0)**	**776**	**(100.0)**

[a] Figures in parentheses are percentages.

outcome should be viewed with concern and warrant urgent investigation.

The major reasons for poor outcome were as follows: the presence of other pre-existing eye diseases; complications resulting from the surgical procedure, either early or late; and poor vision due to inadequate correction of the refractive error, either by spectacles or intraocular lens implantation. We did not investigate the reasons for the poor outcome in the different population groups and hence are unable to determine the importance of each of these factors. However, a study in Nepal of 998 eyes that had undergone intracapsular cataract extraction and received aphakic spectacles, and of which 909 eyes were examined one year after surgery, revealed that outcome was poor for 49 eyes (5.4%), of which 5 (0.6%) had pre-existing eye disease, 29 (3.2%) correctable refractive errors, and 15 (1.7%) complications of the cataract surgery (*11*).

The first step in improving the results of cataract surgery is to develop an awareness of the magnitude and causes of poor outcome. This can be achieved if individual surgeons and hospitals begin to monitor their results on a regular basis using the methods described here or similar methods, and to investigate the reasons for poor outcome. Once the causes are known, action can be taken to improve case selection (avoiding cases for which there is no hope of visual improvement), surgical technique and management of complications. The results of changes in surgical technique should be monitored to ensure that there is a gradual improvement in the quality of outcome.

It is important to recognize that, in developing countries, many patients do not see well after successful cataract surgery because of uncorrected refractive error due to uncomfortable, lost, or broken spectacles. The move to intraocular lens implantation should help to overcome this problem, providing that surgeons are well trained in implantation techniques. The cost-efficiency of biometry in high-volume, low-cost cataract programmes in developing countries has still to be evaluated.

The present study shows that visual outcome following cataract surgery can be monitored on a regular basis using standardized patient records or population-based rapid assessments. Such an exercise is, in itself, likely to improve the outcome of surgery. The proportion of operated eyes with a poor outcome (postoperative visual acuity <6/60 with the available correction) is proposed as the initial indicator for monitoring visual outcome. When poor outcome is high (e.g. >10%), further investigation into the causes is required. ■

Résumé

Surveillance des résultats des opérations de la cataracte en Inde

Dans beaucoup de pays en développement, la cataracte est une cause majeure de cécité et de déficience visuelle grave et le nombre des opérations de la cataracte augmente. Cet article rend compte d'une évaluation, en Inde, de deux méthodes simples de mesure des résultats des opérations de la cataracte qui pourraient être utilisées par les ophtalmologistes et les administrateurs de programmes pour surveiller la qualité des services de chirurgie de la cataracte.

Selon la première méthode, on a analysé les données extraites de relevés standardisés des opérations de la cataracte pratiquées dans trois Etats de l'Inde. Les résultats en matière d'amélioration de la vue ont été classés comme bons (acuité visuelle $\geqslant$ 6/18 avec la correction disponible), limites (6/24-6/60) ou mauvais (<6/60) et les taux de restauration de la vue ont été calculés. Selon la deuxième méthode, des évaluations épidémiologiques rapides randomisées ont été faites dans 20 districts de deux Etats et l'acuité visuelle de toutes les personnes ayant subi une opération de la cataracte a été déterminée.

L'étude de 4168 relevés d'hôpitaux et de camps de soins oculaires a révélé, avec la correction standard disponible, 37,8% de bons résultats, 45,6% de résultats limites et 16,6% de mauvais résultats. Les résultats étaient plus mauvais pour les camps de soins oculaires (20,5%) que pour les hôpitaux (11,4%), mais cela tient peut-être à la sélection des patients. Le pourcentage de

mauvais résultats a été plus élevé chez les sujets ayant reçu des implants intra-oculaires (23,7%) que chez ceux ayant simplement eu des lunettes (15,6%). Cela reflète sans doute les difficultés posées par le passage de la technique chirurgicale d'extraction intracapsulaire à l'extraction extracapsulaire avec pose d'un implant intra-oculaire dans la chambre postérieure, 11% seulement des interventions ayant comporté la pose d'implants.

Selon la deuxième méthode, pour 2401 yeux aphaques/pseudoaphaques examinés dans le cadre d'une étude transversale dans la population de 19 districts de l'Etat de Karnataka, les résultats ont été jugés bons dans 43,5% des cas et mauvais dans 26,4% des cas. Pour 776 yeux examinés dans le cadre d'une étude analogue dans le district d'Ahmedabad de l'Etat de Gujarat, on a obtenu 49,9% de bons résultats et 23,9% de mauvais résultats. Dans l'ensemble, les résultats ont été jugés mauvais pour environ 1 œil sur 4 (26,4% et 23,9% respectivement dans l'Etat de Karnataka et l'Etat de Gujarat). Dans ces deux Etats, les résultats ont été meilleurs avec les implants intra-oculaires (11,4% et 11,6% de mauvais résultats) qu'avec les verres pour aphaques (27,2% et 28% de mauvais résultats). Cette différence tient en partie à ce que des lunettes perdues ou cassées n'avaient pas été remplacées.

Il ressort de ces évaluations que les résultats des opérations de la cataracte sont mauvais pour 15 à 25% des yeux avec la correction disponible. Ils devraient être meilleurs avec une meilleure correction de l'aphaquie. De nouvelles évaluations s'imposent sur les causes de ces mauvais résultats.

L'étude a montré que les résultats des opérations de la cataracte peuvent être contrôlés tous les mois ou régulièrement par les ophtalmologistes à l'aide de relevés standardisés ou d'évaluations rapides dans la population, exercice qui devrait en soi contribuer à une amélioration des résultats. Quand ceux-ci sont trop souvent mauvais (>10%), des évaluations supplémentaires doivent être faites.

Resumen

Vigilancia de la vista tras la cirugía de la catarata en la India

La catarata es una importante causa de ceguera y de trastornos visuales graves en muchos países en desarrollo, y el número de operaciones de catarata no cesa de aumentar. En el presente artículo se describe la evaluación realizada en la India de dos métodos sencillos de medición del estado de la vista tras la corrección quirúrgica de la catarata, métodos que podrían ser utilizados por los oftalmólogos y los administradores de programas para vigilar la calidad de los servicios de cirugía de la catarata.

En el primero de ellos se utilizaron los datos obtenidos a partir de las fichas clínicas ordinarias de las operaciones de cirugía de la catarata llevadas a cabo en tres Estados de la India. La situación de los pacientes se clasificó como buena (agudeza visual $\geqslant$ 6/18 con la corrección disponible), límite (6/24-6/60) o insatisfactoria (<6/60), y se calcularon las tasas de recuperación de la vista. El segundo método consistió en la realización de evaluaciones epidemiológicas rápidas aleatorizadas en 20 distritos de dos Estados, determinándose la agudeza visual de todas las personas que se habían sometido a cirugía de la catarata.

El análisis de 4168 registros de hospitales y campamentos oftalmológicos mostró que, con las medidas correctivas habitualmente empleadas, se conseguían buenos resultados en el 37,8% de los casos, resultados límite en el 45,6%, y resultados insatisfactorios en el 16,6%. Se obtuvieron peores resultados en las operaciones llevadas a cabo en los campamentos oftalmológicos (20,5%) que en las realizadas en hospitales (11,4%), pero ello podría deberse a la selección de los pacientes. El estado de la vista era deficiente en mayor proporción en los ojos con implantes de lentes intraoculares (23,7%) que en los casos en que se usaban gafas (15,6%). Ello puede deberse a las dificultades que entraña la transición de la técnica quirúrgica de extracción intracapsular a la extracción extracapsular seguida de implante de lente intraocular en la cámara posterior, pues sólo se realizaron implantes en un 11% de las intervenciones.

Usando el segundo método, de 2401 ojos aquejados de afaquia/seudoafaquia examinados en un estudio poblacional transversal en 19 distritos del Estado de Karnataka, los resultados fueron buenos en el 43,5% de los casos, e insatisfactorios en el 26,4%. De 776 ojos examinados en un estudio similar llevado a cabo en el distrito de Ahmedabad, en el Estado de Gujarat, los resultados fueron buenos en el 49,9% de los casos, e insatisfactorios en el 23,9%. Globalmente, los resultados fueron insatisfactorios aproximadamente en uno de cada cuatro ojos (26,4% y 23,9% en el Estado de Karnataka y el Estado de Gujarat, respectivamente). En esos dos Estados, los ojos con lentes intraoculares tenían mayor agudeza (malos resultados en el 11,4% y el 11,6% de los casos, respectivamente) que los corregidos con gafas para afaquia (27,2% y 28% respectivamente); esa diferencia era imputable en parte al no reemplazamiento de gafas rotas o extraviadas.

Estas evaluaciones indican que los resultados obtenidos con las medidas correctivas disponibles eran insatisfactorios en el 15%-25% de los ojos sometidos a cirugía de la catarata. Una mejor corrección de la afaquia permitiría probablemente mejorar los resultados. Es necesario seguir evaluando las causas de la mala agudeza visual tras esa operación.

El estudio muestra que los oftalmólogos pueden vigilar la evolución de la agudeza visual tras la cirugía de la catarata, con periodicidad mensual o de manera regular, a partir de las historias clínicas de los pacientes o de evaluaciones rápidas basadas en la población, y que esta medida probablemente puede mejorar por sí misma los resultados de la cirugía. Ante un porcentaje elevado de casos insatisfactorios (>10%) es aconsejable estudiar más a fondo las causas implicadas.

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