Original articles

Causes of sub-optimal cataract surgical outcomes in patients presenting to a teaching hospital

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Abstract

Introduction: Surgical treatment for cataract blindness in India is increasing apace; however, sight restoration after surgery is not always satisfactory.

Objective: To evaluate visual outcome after cataract surgery and causes of sub-optimal outcome, if any.

Materials and methods: A cross-sectional study including the patients who had undergone cataract surgery six months to ten years ago was carried out. The variables studied were visual acuity, demographic and surgical factors and ocular findings. The causes of subnormal outcome was categorized into cataract surgery-related or unrelated.

Statistical analysis: SPSS-17 was used; the Chi-square test was used to determine the association between good outcome and categorical variables; the t-test was used for continuous variables. Multivariate analysis using step-wise logistic regression was done.

Results: Among 644 patients (644 eyes), good outcome (presenting visual acuity 6/18 or better) after surgery was seen in 266 (41.3 %) eyes. Good outcome was significantly related to urban residence, presence of an intraocular lens and absence of ocular co-morbidities or posterior capsule opacification. Borderline and poor outcomes were mainly due to surgery-related causes; treatable causes included uncorrected refractive errors, and posterior capsule opacification. Intra-operative complications resulting in a pulled-up pupil were frequent.

Conclusions: Surgical factors are responsible most often for sub-optimal visual outcome; some, like induced astigmatism and vitreous loss, can be modified with training; actively encouraging follow-up visits can allow treatment of residual refractive errors and capsular opacification.

Key-words: cataract surgery, India, visual impairment

Introduction

By 2020, cataract surgical coverage in India is predicted to increase to 7.63 million per year (Murthy et al, 2008). This demonstrates significant progress in addressing surgical aspects; however, visual recovery after surgery is poor in about 25 % of cases (Limburg et al, 1999a; Anand et al, 2000; Dandona et al, 1999). Various factors are implicated, outcomes varying according to community-based or hospital-based data, duration since surgery, conditions under which operations were conducted (excellent or less favorable), single or diverse surgeons,

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and experience of the surgeon (Limburg et al, 1999b; Reidy et al, 1991; Nirmalan et al, 2002). Poor outcome after cataract surgery is cause for concern; the information, communicated by word of mouth to others with cataract, could create a barrier to surgical intervention (Dhaliwal & Gupta, 2007).

The World Health Organization (WHO) recommendations for acceptable outcomes after cataract surgery are good outcome (6/18 or better) in >85 % of cases, borderline outcome (<6/18 to 6/60) in <10 %, and poor outcome (<6/60) in <5 % of cases (WHO, 1998). Our study seeks to determine proportions and causes of sub-optimal visual outcome following cataract surgery in patients self-presenting to this teaching hospital. The findings could serve as a baseline to suggest ways to improve cataract surgical outcomes.

Materials and methods

This was a hospital-based, cross-sectional, observational study; consecutive persons, aged >45 years, who had undergone surgery for senile cataract in one or both eyes 6 months to10 years ago, self-presented and were recruited. Persons not willing to participate (n=22), with acute conditions precluding vision assessment (n=16), or with decreased hearing or cognition such that they could not cooperate (n=6) were excluded. Recent population based surveys have shown that less than half of the patients operated on for cataract will have vision 6/18 or better after cataract surgery (Limburg et al, 1999a; Anand et al, 2000; Dandona et al, 1999). Sample size calculation was based on this data; the formula used was $n=z^2_{1-\acute{a}/2}\ p(1-p)/d^2$, where $z^2_{1-\acute{a}/2}=1.96$ for 95 % confidence, p=proportion of patients who are expected to get normal vision (50 %), and d=absolute precision required (4.0 %); a sample size of 600 eyes was thus calculated (Indrayan & Sarmukaddam, 2001).

After Institutional Ethical Committee approval and receiving informed consent, demographic data, surgical history and ocular findings were recorded. Presenting and best corrected vision (BCVA) after a current refraction testing was assessed using Snellen's chart; to ensure uniformity the same person (KK) tested vision in all cases. Presenting vision was graded based on the WHO recommendations for acceptable outcomes after cataract surgery into good (6/18 or better), borderline (<6/18 to 6/60) and poor outcome (<6/60).

All causes of borderline or poor outcome in a particular eye were listed, with the condition considered (by all three authors in consultation) to be most influential being designated the principal cause; these were categorized into cataract surgery-related and unrelated causes. Patients with treatable cause of visual deprivation were appropriately managed; all patients underwent a current refraction.

In the case of patients who had undergone cataract surgery in both eyes, one eye was selected for analysis using a random number table. SPSS 17 was used for data analysis. To look for association of variables with visual outcome, categorical data was analyzed using Chi-square and Fisher's exact test; t-test was used for continuous variables. Only those co-variants found significant on univariate testing were considered for forward step-wise logistical analysis. The probability for including a variable was 0.05 and for its removal was 0.10. Hosmer-Lemeshow test was used for Goodness-of-Fit of the model (p=0.223, chi=9.434); this model had a classification accuracy of 75.4 %.

Results

The data included 644 eyes (644 patients) who self-presented between December 2006 and March 2008. Table 1 shows demographic features and surgery-related parameters. Table 2 shows the optical correction used for visual rehabilitation after surgery. Good outcome (presenting vision) after cataract surgery was seen in 266 (41.3 %) eyes, borderline in 290 (45.0 %), and poor outcome in 88 (13.7 %) eyes (Table 3); the table also details improvement in vision after a current refraction (following appropriate treatment of cause where possible). Table 4 shows the main causes of borderline/poor outcomes.

Diabetes was the commonest coexistent systemic disease (51 patients), followed by hypertension (36 patients), coronary artery disease (three patients), pulmonary disease (two patients), and leprosy (one patient).

Normal outcome after surgery was more likely in younger patients (p=0.008); in those with a shorter duration since surgery (p=0.045); in patients from urban locales (p<0.001); when surgery was performed by a senior surgeon (p=0.001); in eyes that underwent phacoemulsification (p<0.001); and in eyes with IOLs implanted in them (p<0.001). Eyes without ocular co-morbidity had a greater likelihood of achieving normal outcome (eyes with corneal or pupillary abnormality, increasing grades of posterior capsular opacification, and optic nerve, or macular pathology were less likely to achieve normal outcome (p<0.001 each). Co-existing systemic disease did not affect visual outcome (p=0.21).

Factors found significant on univariate testing were subjected to step-wise logistic regression (table 5) shows the factors that significantly influenced normal visual outcome after logistic regression.

Discussion

This study dealt with visual outcome after cataract surgery; postoperatively, good outcome with the available correction was seen in less than half the eyes studied. Though similar to some studies from India (Limburg et al, 1999a, 1999b), and unacceptably low compared to others (Reidy et al, 1991; Nirmalan et al, 2002; Vijaya et al, 2010), we did not think it prudent to compare proportions. The main reason is that ours is a hospital based study and we included patients operated elsewhere as well as in-house. Thus, comparisons would be invalid since parameters like community-based versus hospital-based data, duration since surgery, conditions under which operations were conducted (excellent or less favorable), single or diverse surgeons, and experience of the surgeon could vary widely. Secondly, our patients self-presented; there is the possibility of bias in that more patients with visual problems may have presented, thus inflating the proportion with borderline or poor outcome.

The average duration since surgery was longer in our study (>3 years) than in many others (four weeks to one year) (Reidy et al, 1991; Hennig et al, 1992; Prajna et al, 1998). We included a longer time lag since operation (up to 10 years) as it was our intention to study long term outcomes. In addition, being a hospital based study a longer time lag ensured a large sample size. Studies that include recently operated patients report better outcomes (Limburg et al, 1999a, 1999b; Anand et al, 2000); this could be due to improved instrumentation and techniques in recent years, and increasing trend towards phacoemulsification (Vijaya et al, 2010). However, it is quite possible that such studies, with shorter follow up periods, miss surgical complications and ocular morbidities that might intervene later (Anand et al, 2000). Despite the longer follow up, our study, after multivariate analysis, was unable to show any association between outcomes and duration since surgery.

Researchers are divided on the influence of place of residence, with some attributing no significance (Nirmalan et al, 2002), and others reporting poorer outcomes in rural patients (Vijaya et al, 2010; Dandona et al, 1999). In our study too visual outcome was likely to be good in patients from urban locales; perhaps living in proximity to a bigger ophthalmic center, or better awareness and availability of surgical options helps (Vijaya et al, 2010). The older studies collected data several years before we did, suggesting that not much has changed for cataract patients in rural areas; whether it is the lack of appropriate technology, infrastructure, or expert cataract surgeons, rural patients continue to be short changed.

Eyes were more likely to attain good outcome when an intraocular lens was implanted, reinforcing the technical superiority of extracapsular over intracapsular cataract extraction (Nirmalan et al, 2002; Vijaya et al, 2010) As far as extracapsular extraction is concerned, authors have shown that suture-less techniques like phacoemulsification and manual small incision cataract surgery (SICS) give a better visual outcome than conventional extracapsular cataract extraction (Karki et al, 2009; Gurung et al, 2009; Singh et al, 2009). This is reportedly because surgically induced astigmatism is significantly reduced with suture-less small incision procedures. Many of our patients were not using spectacles even years after surgery; the proportion of patients with good outcome jumped from 41.3 to 61.6 % after refraction (Table 3). Most patients reported that they were not using them because spectacles afforded no benefit or were broken. These were patients who had access to hospital services and presented to the hospital; others in the community do not return for follow up and likely remain under-corrected (Pokharel et al, 1998; Gupta et al, 2003). Studies show that the proportion of cataract operated eyes with pseudophakia is increasing in India; perhaps the problem of uncorrected aphakia will reduce over the coming years (Vijaya et al, 2010). With attention to preoperative biometry, and incision morphology and position, surgically induced astigmatism can be minimized. Learning surgeons should thus be well trained in both biometry and phacoemulsification/manual SICS in order to minimize the need for postoperative spectacles (Gurung et al, 2009; Sharma et al, 2009). Many institutions, especially government set ups like ours, provide free intraocular lenses to patients. They could also offer free or subsidized glasses, where needed, to benefit patients who cannot afford them.

Borderline or poor outcomes in this study was most often due to the surgical procedure rather than to unrelated causes; other studies corroborate this finding (Dandona et al, 1999; Vijaya et al, 2010; Verma et al, 1996). In our study, after refractive error, the other common cause of borderline or poor outcome was visually significant posterior capsular opacification. This condition is completely treatable; patients should be actively encouraged by the operating team to report for follow up. Better instrumentation, improved surgical technique, and increasing expertise should reduce the incidence of capsular opacification (Raj et al, 2009; Dandona et al, 1999; Pokharel et al, 1998). Its incidence and severity can further be reduced by using improved designs and materials of intraocular lenses, modifying optic edges, and using optic coatings (Raj et al, 2009).

Pulled up pupil was often a cause of sub-optimal outcome; it is an unfortunate complication related most often to poorly managed vitreous loss. Vitreous disturbances are reported to be more common with learning surgeons, and with the larger incision size of intracapsular or conventional extracapsular cataract extraction (Kothari et al, 2003). It can be avoided with careful attention to the posterior capsule and vitreous humor dynamics. Even when it occurs, expert, appropriate management improves outcome. Learning surgeons should be trained to prevent, recognize, and manage vitreous loss, preferably using mechanized vitrectomy instruments (Kothari et al, 2003).

Other surgery-related causes of poor visual outcome, like corneal edema, retinal detachment and endophthalmitis, were rarely seen in our study. They are reported more often in studies that include mostly aphakic patients (Nirmalan et al, 2002; Dandona et al, 1999). Very few outcome studies have reported cystoid macular edema probably because it is a delayed complication and the follow up period is short; our incidence is comparable with the literature (Dandona et al, 1999).

Causes of poor vision unrelated to cataract surgery were also seen, albeit occasionally; age-related macular degeneration was the most frequent. Such eyes, with ocular co-morbidity, are less likely to achieve good outcomes (Gupta et al, 2003; Ashaye & Komolafe, 2009; Talukder et al, 2009). The advantage of cataract surgery in patients with ocular co-morbidity is therefore debatable; however, ophthalmic surgeons are often constrained to operate. Perhaps, excluding eyes with poor visual prognosis from assessment will give a more realistic picture, gauging the effect on outcome of surgery alone.

Our study has some inherent limitations; being hospital based, it does not reflect what is happening in the community and, therefore, the results are not generally applicable to the community. Moreover, causes of poor outcome may be different from other parts of India.

In conclusion, factors that adversely affect visual outcome in patients self-presenting to this teaching hospital after cataract surgery include rural residence, aphakia, posterior capsule opacification, and ocular co-morbidities. Poor vision is mainly due to the surgical procedure; treatable causes are common and include uncorrected refractive errors and posterior capsule opacification. Intraoperative complications resulting in pulled up pupil are also frequently seen. It should be possible to improve outcomes by better training of ophthalmic surgeons in suture-less techniques, and in management of vitreous disturbances; by minimizing surgically induced astigmatism; and by ensuring follow up to detect and treat posterior capsular opacification and residual refractive error.

Table 1
Demographic features and cataract surgery-related parameters in 644 patients

Parameter	Number of patients (%)
Gender: Females	415 (64.4)
Age (years)	Range: 45-92; Average: 63.17 ± 7.11; Median: 64
45-54	48 (7.5)
55-64	288 (44.7)
65-74	262 (40.7)
75-84	43 (6.7)
85-94	3 (0.5)
Place of residence: Urban	336 (52.2)
Time since surgery (years)	Range 0.5-10; Average 3.62 ± 2.55; Median 3.0
6 months- 1 year	60 (9.3)
>1-5 years	511 (79.3)
>5-10 years	73 (11.3)
Place of surgery: Government hospital	510 (79.2)
Private hospital	87 (13.5)
Eye camp	47 (7.3)
Hierarchy of surgeon: Senior surgeon	472 (73.3)
Junior surgeon	29 (4.5)
Do not know	143 (22.2)

Table 2
Presenting optical correction in 644 eyes after cataract surgery

Site of intraocular lens placement	Extracapsular cataract extraction	Phacoemulsification	Intracapsular cataract extraction	Total
Posterior chamber	483	73	-	556
Anterior chamber	10	-	-	10
None (aphakia)	18	-	60	78*
Total	511	73	60	644

*twenty-six patients (33.3 %) did not have spectacles. The reasons given for not using spectacles was 'no benefit' (53.3 %), 'broken' (37.8 %), 'can see with other eye' (4.4 %) and 'not advised' or 'cannot afford' (2.2 % each).

Table 3
Distribution of cataract surgical outcomes based on presenting vision, and vision after a current refraction

Presenting vision after cataract surgery **N=644 eyes**		
Good outcome (≥6/18) N=266 (41.3 %)	**Borderline outcome** (<6/18 - 6/60) N=290 (45.0 %)	**Poor outcome** (<6/60) N=88 (13.7 %)
After a current refraction		
Overall good outcome N=397 (61.6 %)	**Good outcome:** N=130 **Borderline outcome:** N=160	**Good outcome:** N=1 **Borderline outcome**: N=41 **Poor outcome:** N=46

Table 4
Causes of borderline and poor outcome (presenting vision) after cataract surgery

Principal cause of reduced vision	Borderline outcome (N=290) No (%)	Poor outcome (N=88) No (%)
Related to cataract surgery		
Pertaining to anterior segment		
Uncorrected refractive error	97 (33.4)	7 (7.9)
Posterior capsule opacification	64 (22.1)	16 (18.2)
Pulled up pupil	22 (7.5)	3 (3.4)
Corneal edema	2 (0.7)	3 (3.4)
Pertaining to posterior segment		
Cystoid macular edema	23 (7.9)	4 (4.5)
Retinal detachment	0 (0)	7 (7.9)
Phthisis bulbi (endophthalmitis)	0 (0)	1 (1.1)
Unrelated to cataract surgery		
Pertaining to anterior segment		
Corneal opacity	11 (3.8)	9 (10.2)
Pre-existing glaucoma	10 (3.4)	9 (10.2)
Pertaining to posterior segment		
Age related macular degeneration	36 (12.4)	19 (21.6)
Diabetic retinopathy	18 (6.2)	8 (9.1)
Myopic degeneration	5 (1.7)	2 (2.3)
Hypertensive retinopathy	2 (0.7)	0 (0)

Table 5
Risk factors significantly associated (on step-wise logistical regression) with good visual outcome after cataract surgery

Parameter	**Co-efficient**	**Odds Ratio**	**95 % Confidence interval**	**Signific-ance**
Place of residence (urban)	0.577	1.781	1.215-2.611	0.003
Intraocular lens (present)	2.177	8.820	1.900-40.952	0.005
Corneal pathology (none)	2.325	10.231	3.410-30.693	<0.001
Optic disc (no pathology)	2.009	7.452	2.699-20.577	<0.001
Macula (no pathology)	1.707	5.512	3.494-8.696	<0.001
Posterior capsular opacity (None/grade 1)	3.281*	26.594	10.403-67.985	<0.001

*None of the twenty-eight eyes with grade 3 posterior capsular opacity had normal outcome; these were not included in the analysis

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