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RESEARCH ARTICLE

ASSESSMENT OF THE VISUAL OUTCOMES AFTER CATARACT SURGERY AMONG PEOPLE AGED 50 YEARS AND ABOVE RESIDING IN URBAN SLUMS OF RAIPUR CITY (C.G.) INDIA

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ABSTRACT

**Background:** Cataract is the leading cause of visual impairment in most parts of the developing world, including India. Cataract surgery is a cost-effective intervention in eye care. Poor outcome of cataract surgery is a major problem in developing countries. The aim of this study was to assess the visual outcomes of cataract surgery and to identify factors associated with it among people aged 50 years and above residing in urban slums of Raipur city, Chhattisgarh, India.

**Materials and Methods:** A community based, cross-sectional study was conducted in 30 randomly selected clusters (urban slums) of Raipur city during June 2010 to March 2011. People aged 50 years and above were interviewed, tested for visual acuity and their eyes examined by house to house visits. In cataract operated persons, information about details of cataract surgery were collected using a pre-designed and pre-tested proforma.

**Results:** A total of 895 persons examined, of whom 210 (23.5%) persons had cataract surgery in one or both eyes. Of the 342 cataract-operated eyes, 90.5% had received intra-ocular lens (IOL) implantation. Post-operative visual outcome was good in 84.5% of eyes, borderline in 12.3%, and poor in 3.2% with available correction. A better visual outcome were significantly associated with surgeries at younger age, literacy, IOL surgery, and Private hospital / Charitable or NGO hospital and in recent surgeries but sex of operated person was not important.

**Conclusions:** Outcome of cataract surgery was excellent with 84.5% of operated eyes had achieved a good visual outcome, in study area. However, it can be further improved by adequate post-operative follow-up care and appropriate refractive correction.

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INTRODUCTION

Cataract is the leading cause of visual impairment in most parts of the developing world, including India (Resnikoff *et al.*, 2004). Cataract surgery is a cost-effective intervention in eye care (Lansingh *et al.*, 2007). Even though, cataract surgical targets are being met, a poor outcome of cataract surgery is a major problem in developing countries (Tabin *et al.*, 2008; Johnson, 2000). The causes of poor outcome include pre-existing eye diseases, surgical complications and postoperative refractive error (Johnson, 2000). The quality of cataract surgery is important determinants of surgical uptake and measures of the performance of coordinated cataract surgical programs. Patients with poor outcome may produce a negative attitude towards eye care in the community. High quality surgery often has been seen as the key to driving increases in the demand and uptake of cataract surgical services (Lewallen and Thulasiraj, 2010).

Monitoring the quality of cataract surgery depends on accurate assessment of visual outcomes. The proportion of eyes having a poor outcome following cataract surgery could be used as an indicator to monitor outcome on regular basis. When the proportion of poor outcomes is high (>10%), further investigation into the causes is required (Limburg *et al.*, 1999). Previous population based studies (Bourne, *et al.*, 2007; Shen *et al.*, 2013) have reported that poor postoperative visual outcomes were associated with older age, female gender and illiteracy, non- IOL surgery, surgery performed at an eye camp or government hospital, rural dwelling and year of surgery. So these factors must be identified, in order to improve cataract surgical outcomes, thereby increasing visual rehabilitation and the output of cataract surgical services. Reliable population-based data regarding cataract surgery are lacking in Chhattisgarh. It is important to measure the quality of the surgeries provided to the population. Knowledge of factors affecting the visual outcomes of cataract surgery is also important in designing effective planning of services. Keeping in view the above points, the present study was conducted with

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the aim to assess the visual outcomes of cataract surgery and to identify factors associated with it, among people aged 50 years and above residing in urban slums of Raipur city, Chhattisgarh, India.

## MATERIAL AND METHODS

This community-based, cross-sectional study was conducted in the urban slums of Raipur City (C.G.) during June 2010 to March 2011. The persons who were aged 50 years and above, residing in the selected study clusters for more than 6 months and consenting for interview and eye examination were considered eligible for the study. The method utilized for data collection was 30 cluster sampling method. Each slum was considered as a cluster. The list of 279 slums was obtained from the municipal Corporation Raipur (C.G.). All these slums were arranged in alphabetic order along with their respective & cumulative population. Sampling interval was determined by using the formula (Total cumulative population divided by 30 clusters). Cluster interval was obtained. Then 1st cluster was identified by choosing random number. Subsequent cluster were identified by adding sample interval in random number. Thus 30 clusters (slums) were identified for data collection.

The sample size calculation was based on prevalence of blindness (VA<6/60) in person aged 50 years and above. With the following assumption that prevalence of blindness (PVA<6/60) for person aged 50 years and above is 10% (Neena *et al.*, 2008), relative precision (error bound) of 20%, confidence interval of 95%. By using the formulas  $N=4 pq/L^2$ , the calculated sample size for the present study was 900 persons. Ethical approval for study was obtained from the institution's ethical committee. Verbal informed consent was obtained from all participants before examination. Data collection was done in selected clusters by house to house visits. First all eligible persons in the households were interviewed, then their presenting visual acuity measurement and eye examination was done. Details about the socio-demographic data like age, sex, and literacy status were obtained. A person, who had any formal education, was considered literate for this study. In cataract operated persons, history of cataract surgery including person's age at time of surgery, the place and type of surgery, duration since surgery and the use of spectacle and reasons for not using spectacles, was also recorded. All information was recorded in a pre-designed and pre-tested proforma.

Presenting visual acuity (PVA) was measured using the Snellen's or illiterate E chart, in each eye separately. The test took place at in front of the house during the full daylight. Outcomes of cataract surgery were categorized according to WHO criteria, as good, borderline and poor using presenting visual acuity which were defined as visual acuity  $\geq 6/18$ ,  $6/60 \leq$  visual acuity  $< 6/18$  and visual acuity  $< 6/60$ , respectively with available correction (WHO, 1998). After measuring visual acuity, eye examination was performed in shaded dark area of the house. Lens status of all examined persons was recorded. At least three visits were paid to the chosen households, to interview and examine all eligible persons, if a person was not available in house, even after repeated visits declared absent.

## Data analysis

Collected data were entered in the Microsoft excel sheet and checked for its completeness and correctness (five proforma were rejected during this process) before data analysis. The chi-square test was used to determine the associations of different cataract related parameters like age at time of surgery, sex, literacy, place of surgery, type of surgery and time of surgery with visual outcomes in post-operated eyes. P values  $\leq 0.05$  was considered statistically significant.

## RESULTS

Of the 895 examined persons, 210 persons (342 eyes) had undergone cataract surgery in one (78 persons, 37.1%) or both eyes (132 persons, 62.9%), representing a cataract surgery prevalence of 23.5%. Majority of cataract operated persons (48.7%) were in the age group of 60-69 years, while only 18.7% were aged between 50-59 years at the time of examination. In addition, most of the cataract operated persons were males (59.6%) and illiterate (62.4%) (Table 1).

**Table 1. Socio – demographic characteristics of cataract operated persons**

Characteristics	No.	%
Age group (in years)		
50-59	40	18.7
60-69	101	48.7
$\geq 70$	69	32.6
Sex		
Male	126	59.6
Female	84	40.4
Literacy		
Literate	79	37.6
Illiterate	131	62.4
Total	210	100

Nearly 63% of cataract operated persons were not using spectacles after the cataract surgery. Main reasons for not using spectacles that 72.7% persons were never provided spectacles while 22.7% persons felt no need to use spectacles and, 2.3% persons had lost and 2.3% had broken spectacles.

Among the 342 cataract operated eyes, 63.2% of eyes were operated between ages 60-69 years while 24.8% were operated between ages 50 to 59 years. Only 3.51% of eyes were operated in persons aged less than 50 years. Majority of the cataract surgeries (63.2%) were performed in males and 59.4% in illiterates. There were almost 90.4% surgeries where intra ocular lens (IOL) implanted as against 9.6% aphakic surgeries. Majority of eyes (30.1%) were operated in Charitable/NGO hospitals followed by 29.2% in private hospitals, 21% in Govt. hospitals. Only 19.6% of eyes were operated in eye camps. Most surgeries (37.7%) had been performed within 1 year and only 10.8% of surgeries had been performed before 10 years prior to examination (Table 2). Post-operative visual outcome was good in 84.5% of eyes, borderline in 12.3%, and poor in 3.2% with available correction (Table 3). Better visual outcomes were observed in younger persons compared with that achieved by older once and this difference was significant ( $p < 0.0001$ ). Although outcomes was higher in males (87%) than females (80.2%), but this difference was not significant ( $p = 0.07$ ). Outcomes were higher in literate persons than illiterate (94.2% had good outcome compared to 77.8% respectively,  $p = 0.0001$ )

**Table 2. Cataract related parameters of cataract operated eyes**

Parameters	No.	%
Age (in years) at the time of surgery		
<50	12	3.5
50-59	85	24.8
60-69	216	63.2
≥70	29	8.5
Sex		
Male	216	63.2
Female	126	36.8
Literacy		
Literate	139	40.6
Illiterate	203	59.4
Type of surgery		
IOL	309	90.4
Non-IOL	33	9.6
Place of surgery		
Eye camps	67	19.6
NGO/Charitable Hospital	103	30.1
Government Hospital	72	21.0
Private Hospital	100	29.2
Duration since surgery		
<1 year	129	37.7
≥1-5 year	115	33.6
5-10 year	61	17.8
>10 year	37	10.8
Total	342	100

**IOL- Intraocular lens****Table 3. Outcomes of cataract surgery among cataract operated eyes**

Visual outcome	No.	%
Good (PVA ≥6/18)	289	84.5
Borderline (PVA 6/24-6/60)	42	12.3
Poor (PVA <6/60)	11	3.2
Total	342	100

PVA: Presenting Visual Acuity

**Table 4. Association of outcomes of cataract surgery of operated eyes with cataract related parameters**

Parameters	Total operated eyes	Good		Borderline		Poor		Total
		No.	%	No.	%	No.	%	
Age at time of surgery (in years)								
<50	12	9	75.0	2	16.7	1	8.3	$\chi^2 = 30.23, d.f.6, p<0.0001$
50-59	85	76	89.4	7	8.2	2	2.3	
60-69	216	189	87.5	23	10.6	4	1.8	
≥70	29	15	51.7	10	34.5	4	13.8	
Sex								
Male	216	188	87.0	20	9.3	8	3.7	$\chi^2 = 5.23, d.f.2, p=0.07$
Female	126	101	80.2	22	17.5	3	2.4	
Literacy								
Literate	139	131	94.2	5	3.6	3	2.2	$\chi^2 = 17.82, d.f.2, p=0.0001$
Illiterate	203	158	77.8	37	18.2	8	3.9	
Type of surgery								
IOL	309	275	89	29	9.4	5	1.6	$\chi^2 = 54.94, d.f.2, p<0.0001$
Non-IOL	33	14	42.4	13	39.4	6	18.2	
Place of surgery								
Eye camps	67	55	82.1	7	10.4	5	7.5	$\chi^2 = 22.66, d.f.6, p=0.0009$
NGO/Charitable Hospital	103	91	88.4	10	9.7	2	1.9	
Government Hospital	72	52	72.2	19	26.4	1	1.4	
Private Hospital	100	91	91	6	6	3	3	
Duration since surgery								
<1 year	129	125	96.9	4	3.1	0	0	$\chi^2 = 57.24, d.f.6, p<0.0001$
≥1-5 year	115	100	87	12	10.4	3	2.6	
5-10 year	61	46	75.4	12	19.7	3	4.9	
>10 year	37	18	48.7	14	37.8	5	13.5	

IOL- Intra ocular lens

IOL surgeries achieved better results than non-IOL surgeries (89% had attained good outcome compared to 42.4% respectively,  $p<0.0001$ )

Surgeries in private hospitals and NGOs hospitals resulted in good results compared to eye camps or government hospital. Cataract surgeries performed during <1 year prior to the examination had better outcome (PVA > 6/18) compared to those conducted 1-5 years, 5-10 years, or more than 10 years ago. Visual outcomes of cataract surgery was significantly associated with place of surgery ( $p=0.0009$ ) with duration since surgery ( $p<0.0001$ ) (Table 4).

**DISCUSSION**

This study provides data on visual outcomes of cataract surgery and factors associated with it among people aged 50 years and above in urban slums of Raipur city, Chhattisgarh, India. This population-based study includes persons that have undergone cataract surgery recently as well as decades earlier. The prevalence of cataract surgery (23.5%) in study area was high compared to study conducted in Gujarat (17.6%) (Murthy *et al.*, 2009), Tirunelveli (11.8%) (Nirmalan *et al.*, 2002), Rajasthan (12.8%) (Murthy *et al.*, 2001), Andhra Pradesh (15.4%) (Khanna *et al.*, 2012) of India, Pakistan (7%) (Anjum *et al.*, 2015), Nepal (9.8%) (Sapkota *et al.*, 2010) and China (4.4%) (Huang *et al.*, 2011), but similar to the study of Nigeria (23.5%) (Odugbo *et al.*, 2012). This difference was probably due to this study was done in urban setting (Raipur city) with the better availability and accessibility of cataract surgical services. In current study, most of the cataract operations (90.5%) were done with IOL implantation, which is very impressive performance. The goal of the national program to perform 80% of the cataract surgeries with IOLs (NPCB, 2014) had been achieved in the present study.

This finding reflects the improvement of surgical technique in the study area. The proportion of IOL surgery in current study was much higher than those in Gujarat (84.1%) (Murthy *et al.*,

2009), Tirunelveli (63%) (Nirmalan *et al.*, 2002), Rajasthan (5.8%) (Murthy *et al.*, 2001), Andhra Pradesh (85%) (Khanna *et al.*, 2012) of India, Pakistan (44.5%) (Anjum *et al.*, 2006), Nepal (73.8%) (Sapkota *et al.*, 2010) and China (87.8%) (Huang *et al.*, 2011) Nigeria (34.4%) (Odugbo *et al.*, 2012) and Bangladesh (10%) (Bourne *et al.*, 2003) studies. Possible reason for these results could be that study was conducted during different time period and differences in the availability of eye care services.

One of the most striking finding of study was that 62.9% of cataract operated persons were not wearing spectacles. The main reason for not using spectacle correction was that 72.7% persons were not provided spectacles after operation. This finding shows that follow up services after cataract surgery is poor in study area. The use of spectacles of 37.1% as found in current study was comparable to that reported in Tirunelveli (35%) (Nirmalan *et al.*, 2002), and higher than that reported in Andhra Pradesh (25.4%) (Khanna *et al.*, 2012) and in Nigeria (28.8%) (Odugbo *et al.*, 2012), but lower than Rajasthan (56%) (Murthy *et al.*, 2001) and Gujarat (54.2%) (Murthy *et al.*, 2009) studies. This finding indicated that improvement in visual outcome is possible, if follow up services are strengthened and with adequate optical correction.

Moreover, this study also reflects that once spectacles were lost or broken are rarely replaced by cataract operated persons. This is the issue that needs to address to improve the outcome of cataract surgery. Some studies (Limburg *et al.*, 1999) also reported that in developing countries, many do not see well after successful cataract surgery because of uncorrected refractive error due to uncomfortable, lost, or broken spectacles. So these study findings emphasize the need for proper post-operative refractions, provision of glasses and adequate follow-up following cataract surgery to reduce the proportion of borderline and poor outcomes after cataract surgery in study area.

The visual outcome cataract surgery in our study was excellent. The proportion of eyes with good outcome ( $VA \geq 6/18$ ) was 84.5% while 12.3% had a borderline outcome ( $VA < 6/18$  and  $\geq 6/60$ ) and 3.2% had a poor outcome ( $VA < 6/60$ ) with available correction. The WHO suggests that  $\geq 85\%$  of eyes undergoing cataract surgery should have good outcomes ( $6/6-6/18$ ),  $<10\%$  have borderline outcomes ( $<6/18-6/60$ ), while  $< 5\%$  have poor outcomes ( $<6/60$ ) with available correction as adequate outcome (WHO 1998). So cataract surgical services in study area nearly meet WHO standards.

The good outcome of 84.5% as found in the present study was comparable to WHO guidelines (85%) (WHO 1998) and much higher than that reported in Gujarat (50.7%) (Murthy *et al.*, 2009), Tirunelveli (59.4%) (Nirmalan *et al.*, 2002), Rajasthan (31.5%) (Murthy *et al.*, 2001) and Andhra Pradesh (68.2%) (Khanna *et al.*, 2012) of India, Pakistan (5.5%) (Anjum *et al.*, 2006), China (62.2%) (Huang *et al.*, 2011), Nigeria (25.6%) (Odugbo *et al.*, 2012) and Bangladesh (60%) (Wadud *et al.*, 2006) studies. These results could be explained by differences in study population, proportion of operated eyes receiving IOL implantation and quality of eye care services. The poor outcome that found in this study (3.2%) was less than WHO

recommended value (5%) (WHO 1998). Proportion of poor outcome was much higher for aphakics (18.2%) than pseudophakics (1.6%) in this population. The poor outcome of current study was much lower than those reported in Gujarat (18%) (Murthy *et al.*, 2009), Tirunelveli (11.8%) (Nirmalan *et al.*, 2002), Rajasthan (44.1%) (Murthy *et al.*, 2001) and Andhra Pradesh (14.2%) (Khanna *et al.*, 2012) of India, Pakistan (43.1%) (Anjum *et al.*, 2006), Nepal (20%) (Sapkota *et al.*, 2010), China (15.6%) (Huang *et al.*, 2011) Nigeria (58.3%) (Odugbo *et al.*, 2012), and Bangladesh (23.5%) (Wadud *et al.*, 2006) studies. A similar low proportion of poor outcome was also reported in other developing countries in the range 3-5% (Hennig *et al.*, 1992). This result could be due to the difference in the proportion of aphakics. As the prevalence of aphakia in a population decreases, the proportion of poor outcome also reduces simultaneously.

This study also indicated that there were some socio-demographic factors that have a relationship with the visual outcomes after cataract surgery. Some other variable like type of surgery, place of surgery and time since surgery were also found to be significantly associated with visual outcomes of cataract surgery.

Better visual outcomes were observed in younger persons compared with that achieved by older once. This result was consistent with other previous studies (Murthy *et al.*, 2009; Westcott *et al.*, 2000). This shows that timely intervention is very important. Natural aging and delayed surgery negatively impact postoperative visual outcomes (Lumme and Laatikainen 1993; Willerscheidt *et al.*, 1995). Older people are more likely to have co-morbidities both general health and eye related which could result in higher rates of bad outcomes.

Although outcomes was higher in males (87%) than females (80.2%), but this difference was not significant ( $p= 0.07$ ). Thus gender did not seem to influence cataract surgical outcome. A Similar finding has been reported in other studies (Nirmalan *et al.*, 2002; Bourne *et al.*, 2003). Outcomes were higher in literate persons than illiterate (94.2% had good outcome compared to 77.8% respectively,  $p=0.0001$ ) in this population. Similar finding was also reported in the other community based studies (Murthy *et al.*, 2009; Odugbo *et al.*, 2012). People who are less educated may not follow physician's recommendations related to post-surgical treatment and care.

This study found that visual outcome following cataract surgery was better with IOL than non IOL. A Similar finding has been reported in other population-based studies (Murthy *et al.*, 2009; Nirmalan *et al.*, 2002; Khanna *et al.*, 2012; Anjum *et al.*, 2006; Sapkota *et al.*, 2010; Odugbo *et al.*, 2009). This finding suggests that increasing cataract surgery with IOL implantation would reduce the number of eyes with poor outcome after cataract surgery.

Present study revealed that surgeries in Private hospital/Charitable or NGO hospital had better visual outcome than eye camps or government hospital. A similar finding was also observed in other studies (Murthy *et al.*, 2009; Bourne *et al.*, 2003). Operation performed under eye camp situations tended to have a higher rate of poor outcome than those cases

performed in hospital situation. Poor outcome associated with eye camp surgeries may be due to a less thorough preoperative examination to exclude coexistent ocular pathology (poor case selection) and operative complications (Johnson, 2000). Consistent with findings from other studies (Murthy *et al.*, 2009; Nirmalan *et al.*, 2002; Anjum *et al.*, 2006; Odugbo *et al.*, 2012) present study also revealed that the shorter the duration between the surgery and examination, better the outcome in cataract operated eyes. This result suggests that there has been improvement in quality of eye care services in recent years.

## Conclusion

Outcome of cataract surgery was excellent with 84.5% of operated eyes had achieved a good visual outcome, in study area. However, it can be further improved by adequate post-operative follow-up care and appropriate refractive correction. Finding of this study will provide baseline data of cataract surgical services for designing effective planning of services, in study area.

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