

# Surgical coverage of cataract in a rural area of north India: A cross-sectional study

Shalini Sobti<sup>1</sup>, Bhavna Sahni<sup>2</sup>, Kiran Bala<sup>2</sup>

<sup>1</sup>Department of Community Medicine, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu, J and K,

<sup>2</sup>Department of Community Medicine, Govt. Medical College, Jammu, J and K, India

## ABSTRACT

**Background:** India has the highest number of blind people globally, unoperated cataract being the most common cause of blindness and low vision. Although safe and effective cataract surgical techniques are available, the cataract burden continues to increase annually, due to the backlog of patients to be operated upon, and a growing number of cataract cases due to increased life expectancy. **Aim:** To assess cataract surgical coverage (CSC) in a rural area of north India. **Methods:** A population-based cross-sectional study of CSC among adults (40 years and above) was carried out in two villages of a block in north India using a predesigned questionnaire, visual acuity assessment, and distant direct ophthalmoscopy. Based on the data obtained, CSC (VA <6/60) for both “persons” as well as “eyes” was calculated. Results: Overall, CSC (persons) of 43.20% was observed, 29.31% coverage among persons with unilateral cataract and 50.45% among persons with bilateral cataract while CSC (eyes) was found to be 37.14%, being significantly higher (43.56%) among females compared to males (28.21%) ( $P = 0.012$ ). Around 50% of cataract surgeries were performed in private facilities, 41.35% in government facilities, and rest 8.65% in eye camps. Nearly 90.38% were implanted intraocular lens and 9.62% were non-intraocular lens surgeries. **Conclusions:** Surgical needs for cataract are currently not being met effectively. Reasons for inadequate cataract surgical services need to be sought and addressed to improve the uptake of existing services. Further, reasons for underutilization of government hospitals for cataract surgeries need to be examined.

**Keywords:** Cataract surgical coverage, cross-sectional study, distant direct ophthalmoscopy, questionnaire

## Introduction

India has the highest number of blind people worldwide (over 9 million), with the most common cause of blindness and low vision being unoperated cataract, as indicated by several population-based studies over the past two decades.<sup>[1-4]</sup> In India alone, 3.8 million people become blind from cataracts each year.<sup>[5]</sup>

In comparison to the developed countries, the developing ones have a higher prevalence and earlier age of onset of cataract,

which makes the social and medical cost of cataract-related blindness exorbitantly high in such countries.<sup>[6]</sup> Particularly in rural areas, there are often large numbers of persons who are blind from cataract and whose sight could be restored by relatively simple surgical procedures.

Although safe and effective cataract surgical techniques are available that could restore normal vision to a large number of those affected, the cataract burden continues to increase annually, because of the backlog of patients to be operated on, and the growing number of cataract cases due to increased life expectancy. Moreover, the availability of cataract surgical services is not uniform across the globe. Further, the mere availability of cataract surgical services does not suffice as there exist social and economic barriers to the utilization of these services. All these factors collectively are responsible for the high prevalence of blindness due to cataracts.

**Address for correspondence:** Dr. Shalini Sobti, D-9, New Medical Enclave, Bakshi Nagar, Jammu, J and K - 180 001, India. E-mail: shalinisobti@yahoo.com

Received: 01-04-2020

Revised: 26-04-2020

Accepted: 08-05-2020

Published: 25-08-2020

### Access this article online

#### Quick Response Code:



Website:  
www.jfmipc.com

DOI:  
10.4103/jfmipc.jfmipc\_520\_20

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**How to cite this article:** Sobti S, Sahni B, Bala K. Surgical coverage of cataract in a rural area of north India: A cross-sectional study. J Family Med Prim Care 2020;9:4112-7.

Since cataract is the commonest cause of blindness, intervention against cataract blindness has received priority attention in the global initiative called “VISION 2020: The Right to Sight”<sup>[7]</sup> which is committed to eliminating avoidable blindness, especially due to cataract by increasing the number and quality of cataract surgeries to achieve the satisfactory visual outcome and improved quality of life by the year 2020.

To assess the extent to which the cataract surgical services have met the need of the community, the present study has been carried out in a rural area with cataract surgical coverage (CSC) as a quantifiable measure of the same.

## Methodology

A population-based cross-sectional study of CSC among adults aged 40 years and above was carried out in two villages of a rural area in north India. Ethical approval for this study was obtained from the institutional ethics committee (vide letter number: Pharma/IEC/2010/91 dated 15-03-2010).

In all, there were 23 villages in the block out of which two were selected by simple random sampling.

To ensure better coverage of the eligible persons, local health workers (ASHAs) in the villages were contacted well in advance, briefed about the study, and asked to share this information with the residents of the selected villages.

In the meantime, investigators acquired the requisite skill for visual acuity (VA) assessment and examining lens by distant direct ophthalmoscopy by undergoing 5 days of training in the department of ophthalmology of the institute.

To collect the data, a house-to-house survey was taken up in the selected villages. Residents aged 40 years and above were identified and after taking their informed verbal consent, were interviewed to fill in a predesigned questionnaire for obtaining demographic data and cataract surgical history. This was followed by ocular examination using a torch and VA assessment, for each eye separately, using Snellen’s chart/Landolt C chart and pinhole. Those presenting with a VA < 6/60 with no improvement with a pinhole in the better eye were then subjected to distant direct ophthalmoscopy in a semi-dark room (dilatation of pupil using 1% tropicamide eye drops was done, wherever required) as the use of pinhole corrects vision loss due to refractive error, which can be corrected by spectacles and thus, helps in ruling out refractive errors as a cause of low vision.

## Exclusion criteria

Those who were not willing to participate and those who could not be contacted despite two visits paid to their homes by the investigators after fixing an appropriate time and date with other household members/neighbors.

## Terms used

An operable cataract is defined as pin-hole VA of < 6/60 in the better eye, where the principal cause was cataract.<sup>[8]</sup>

An operated cataract is defined as the presence of pseudophakia (implanted IOL) or aphakia (no IOL) as observed on distant direct ophthalmoscopy.

CSC is defined as the number of people (or eyes) in a defined population with operated cataracts as a proportion of those having operable plus operated cataracts.<sup>[9]</sup>

CSC indicates to what extent the services have covered the needs.<sup>[9]</sup>

However, those already operated for cataracts were assumed to be having a VA < 6/60 at the time of surgery, as it was not possible to assess VA in retrospect.

The data thus collected was then compiled, tabulated, and statistically analyzed using appropriate statistical techniques, which included percentages and Chi-square test (with Yates’ correction wherever applicable) using OpenEpi Version 3.01.

## Results

A total of 683 subjects eligible for the study were interviewed and examined. Out of them, 58 cases were found to have a unilateral cataract and 111 cases had bilateral cataracts, i.e. in all, there were  $58 + 111 = 169$  cataract cases; in other words,  $58 \times 1 + 111 \times 2 = 280$  cataract eyes.

Table 1 shows that out of 169 cataract cases, only 124 (73.37%) were aware of their cataract status while the rest of the 45 cases were unaware of the same and were diagnosed during the study by the investigators. Among the already diagnosed cases, 73 (58.87%) had undergone cataract surgery. Overall, a CSC (persons) of 43.20% ( $n = 73$ ) was observed, which shows that just 4 out of 10 cataract cases sought the surgical services for restoration of vision in the affected eye.

Among the unilateral and bilateral cataract cases, 29.31% ( $n = 17$ ) and 50.45% ( $n = 56$ ) persons underwent cataract surgery, respectively.

CSC (eyes) was found to be 37.14% ( $n = 104$  eyes), being 43.56% ( $n = 71$ ) among females and 28.21% ( $n = 33$ ) among males and the difference was found to be statistically significant at  $p$  value = 0.012 [Table 2].

Among the 73 cataract cases (persons) operated, a total of 104 cataract surgeries were performed, out of which, the majority ( $n = 94$ ; 90.38%) were intraocular lens (IOL) surgeries in comparison to non IOL surgeries which constituted only 9.62% ( $n = 10$ ) of the total. It was observed that females outnumbered males among

**Table 1: Surgical coverage among the cataract cases**

	Subjects operated for cataract n (%)	Subjects not operated for cataract n (%)	Total cases n
<b>TIME OF DIAGNOSIS</b>			
Already diagnosed	73 (58.87)	51 (41.13)	124
Diagnosed during the study period	00 (0.00)	45 (100.00)	45
Total	73 (43.20)	96 (56.80)	169
<b>CATARACT TYPE*</b>			
Unilateral cataract	17 (29.31)	41 (70.69)	58
Bilateral cataract	56 (50.45)	55 (49.55)	111
Total	73 (43.20)	96 (56.80)	169

\*Yates corrected  $\chi^2=6.104$ ;  $P=0.013$ ; Significant

**Table 2: Sex-wise surgical coverage (eyes) of cataract**

Sex	Eyes operated for cataract	Eyes not operated for cataract	Total no. of eyes with cataract	Surgical coverage (%)
Males	33	84	117	28.21
Females	71	92	163	43.56
Total	104	176	280	37.14

Yates corrected  $\chi^2=6.235$ ;  $P=0.012$ ; Significant

beneficiaries. Moreover, proportionately fewer males ( $n = 28$ ; 84.85%) were implanted IOL as compared to females ( $n = 66$ ; 92.96%) [Table 3].

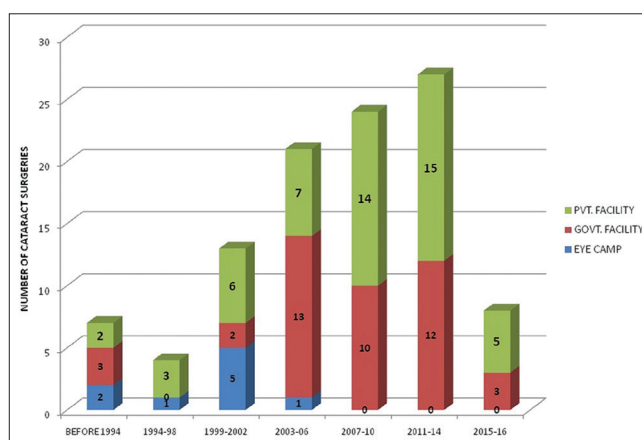
As far as the age of the individual at the time of surgery was concerned, it was seen that majority of the surgeries (29 + 31 out of 104, i.e. 57.69%) were conducted in fifth and sixth decades, as shown in Table 3. It was further observed that with an increase in age, the number of surgeries went on increasing until the sixth decade of life following which a decline in the number of surgeries was observed.

As shown in Table 4, operated cases have been stratified according to the year of surgery. The majority of the cataract surgeries conducted before 1994 were non-IOL surgeries as compared to the subsequent years where the majority were IOL implantation type surgeries.

As is evident from Figure 1, there has been a progressive increase in the number of people going in for cataract surgery. Overall, healthcare utilization pattern was observed to be more inclined towards private rather than government facility. Further, a change in the trend is evident with the cessation of eye-camp approach to perform cataract surgeries in 2006 and a gradual increase in the number of people going in for cataract surgery at private facilities as compared to government facilities. Overall, majority of these surgeries were performed in private facility ( $n = 52$ ; 50%), 41.35% ( $n = 43$ ) in government facility, and the rest 8.65% ( $n = 9$ ) in eye camps.

## Discussion

CSC measures the effectiveness of the cataract intervention program in providing surgical services and, as such, it is an output indicator and does not measure the quality of cataract intervention.<sup>[9]</sup>



**Figure 1: Year-wise distribution of cataract surgeries based on place of surgery**

Taking VA of  $<6/60$  due to cataract as the criteria in the present study, an overall CSC (persons) of 43.20% was observed, 29.31% among those having unilateral cataract and 50.45% amongst those having bilateral cataract; while as CSC (eyes) was found to be 37.14%. Low CSC can be attributed to the fact that more than 1/4<sup>th</sup> of the study participants (45 out of 169 = 26.63%) were not aware that their low vision was the result of cataract. In contrast, a study conducted in Paraguay revealed a CSC (persons) of 36% for persons with bilateral VA  $<6/60$ ; and 28% for any eye with VA  $<6/60$  due to cataract.<sup>[10]</sup> A study from Nepal reported a CSC of 59.5% among the cataract blind having VA of  $<6/60$ .<sup>[11]</sup> On the other hand, in a tribal area in Pakistan, the CSC for people with bilateral cataract blindness (VA  $<3/60$ ) was 60.9%.<sup>[12]</sup> Higher surgical coverage compared to the present study can be explained based on different VA cutoffs taken. However, in another study carried out in Sri Lanka, a CSC of 79.1% was calculated for vision  $<6/60$  among adults aged  $\geq 40$  years.<sup>[13]</sup> Similarly, at the same VA cutoff as the present study (VA  $<6/60$ ), higher CSC of 59.7% for eyes and 79.4% for

**Table 3: Distribution of operated cases by type of surgery and age at surgery**

	Males n (%)	Females n (%)	Total
<b>TYPE OF SURGERY†</b>			
Non-IOL	5 (15.15)	5 (7.04)	10 (9.62)
IOL	28 (84.85)	66 (92.96)	94 (90.38)
Total	33	71	104
<b>AGE AT SURGERY</b>			
40-49	3 (25.00)	9 (75.00)	12
50-59	14 (48.28)	15 (51.72)	29
60-69	6 (19.35)	25 (80.65)	31
70-79	5 (22.73)	17 (77.27)	22
≥80	5 (50.00)	5 (50.00)	10
Total	33 (31.73)	71 (68.27)	104

†Yates' corrected  $\chi^2=0.4784$ ;  $P=0.489$ ; Insignificant**Table 4: Year-wise distribution of cataract surgeries based on the type of surgery**

Year	Type of surgery		Total
	Non-IOL surgery n (%)	IOL surgery n (%)	
Before 1994	4 (57.14)	3 (42.86)	7
1994-1998	0 (0.00)	4 (100.00)	4
1999-2002	3 (23.08)	10 (76.92)	13
2003-2006	2 (9.52)	19 (90.48)	21
2007-2010	0 (0.00)	24 (100.00)	24
2011-2014	1 (3.70)	26 (96.30)	27
2015-2016	0 (0.00)	8 (100.00)	8
Total	10 (9.62)	94 (90.38)	104

persons among people aged  $\geq 50$  years has been reported from Bihar.<sup>[14]</sup> Further, compared to the present study, our neighboring country Bhutan recently reported a much higher CSC (persons) of 83.2% at VA  $< 6/60$  based on Rapid Assessment of Avoidable Blindness survey (RAAB-2018).<sup>[15]</sup> In a RAAB survey conducted in 16 districts in India during 2006–2007 among persons aged  $\geq 50$  years, a CSC (persons) of 66.0% at a VA cutoff of  $< 6/60$  was reported.<sup>[16]</sup> In another study conducted in 6 Indian states using VA  $< 6/60$  cutoff, the CSC was estimated as 75.0% in persons aged  $\geq 50$  years.<sup>[17]</sup> This huge contrast in CSC of 43.20% observed in our study, in comparison to the RAAB survey (66.0%) and the 6 Indian states study (75.0%) could be explained based on the fact that cataract surgical services are not uniformly distributed across the country. In a study conducted by Hans Limburg and Allen Foster on persons aged 50 years and older in Gujarat and Ahmedabad, the CSC for VA  $< 6/60$  was 40.1% for persons and 26% for eyes.<sup>[9]</sup>

In a study carried out in urban slums of Raipur city, Chhattisgarh among 50 years and above, CSC for VA cutoff of  $< 6/60$  was 94.1% for people and 82.6% for eyes.<sup>[18]</sup>

As far as gender difference in uptake of cataract surgeries is concerned, in our study, CSC (eyes) was found to be significantly higher for females compared to males (43.56% vs. 28.21%; with  $P$  value = 0.012). On the contrary, in the study conducted in south India, surgical coverage for cataract was found to be significantly higher for males than females (74.4% vs. 60.5%; with

a  $P$  value of  $< 0.001$ ).<sup>[19]</sup> In the Pakistan study, out of a total of 218 surgeries, 61.9% surgeries were performed on men while the CSC for eyes was 46.0%, that is, 49.5% and 41.3% for men's eyes and women's, respectively.<sup>[12]</sup> In the Chhattisgarh study, CSC was observed to be higher in men (95.3%) than women (92.1%) although this was not statistically significant ( $P = 0.39$ ).<sup>[18]</sup> The study from six Indian states did not find any gender difference, with the CSC (persons at VA  $< 6/60$ ) being 74.5% and 75.4% for males and females, respectively. Further, from bivariable as well as multivariable logistic regression model, it was noticed that, though not significant, women had higher odds of prevalence of cataract surgery ( $P = 0.115$ ), from which they concluded that a noticeable improvement had occurred in terms of access to the cataract surgical services by women recently thereby suggesting that the scenario had changed significantly from a past situation where lower female access to cataract services was reported.<sup>[17]</sup>

In the present study, the majority of the cataract surgeries were performed in a private facility (50%), 41.35% in a government facility, and the rest 8.65% in eye camps. A gradual decline in the number of surgeries performed at eye-camps was observed after 2002 with none of the surgeries performed there, after the year 2007. This finding is in tune with the GOI's decision of doing away with the surgical eye camps which were supposed to be utilized thereafter just for screening purposes and not for performing surgeries. In contrast, in a tribal area of Pakistan, the majority were performed in charity hospitals (49.5%), 38.1% in eye camps, 4.1% at public hospitals, and only 0.9% in private hospitals.<sup>[12]</sup> A study from south India revealed no significant difference in the type of facility used for cataract surgery (private/NGO sector, government sector, or surgical camps).<sup>[19]</sup> A recently published study from Hungary reported that 98.8% of cataract operations having been conducted in government hospitals and a mere 1.2% in private hospitals.<sup>[20]</sup>

Regarding the type of cataract surgery, in the Pakistan study,<sup>[12]</sup> the majority of these surgeries were non-IOL (55.5%) compared to the present study where the majority were implanted IOL (90.38%) and just 9.62% were non-IOL surgeries. Similar findings were reported from the studies from Bhutan and Hungary, where out of the total cataract surgeries performed, 97.6% and 98.6%, respectively, had an IOL implanted.<sup>[15,20]</sup> A study from south India by Nirmalan *et al.* revealed no significant difference in the type of surgical procedure for cataract extraction ( $P = 0.060$ ).<sup>[19]</sup>

This paper highlights the low coverage of cataract surgical services in rural areas of north India. Although cataract is an avoidable cause of blindness, owing to the improved surgical techniques available which can restore vision to a large extent, CSC remains very low. Primary care physicians (PCPs), being the first point of contact for the community, have a major role in creating awareness about cataracts, its prevention, and carrying out screening and referral for cataract surgery. In a resource crunch country like ours, where we do not have a sufficient number of ophthalmic assistants, our PCPs can be trained to detect cataract blindness and refer them for cataract

surgery. This paper further highlights the inclination of rural people towards private facilities for undergoing cataract surgery despite having to bear the expenses from their own pockets in contrast to the free services available at government facilities, thus, indirectly indicating some degree of dissatisfaction with the government facilities. Being closest to the rural community, our PCPs are in the best position to seek and bring to the notice of the higher authorities the reasons for the same so that measures for improving utilization of government facilities can be taken accordingly.

### Limitation

Those already operated for cataract were assumed to be having a VA <6/60 at the time of surgery, as it was not possible to assess VA in retrospect.

### Key Points

- CSC (person) remains low with less than half of those having cataract having undergone surgery.
- CSC (eyes) was found to be significantly higher among females compared to males.
- Rising preference of private facility over government facility for cataract surgery has been observed.
- The majority of the cataract surgeries were IOL type.

### Conclusion

Poor coverage of cataract surgical services observed in the present study highlights the fact that the cataract surgical needs are currently not being met adequately. To improve the uptake of existing services, barriers to the same need to be sought and addressed. Further, reasons for underutilization of government hospitals for cataract surgeries, as observed in the present study, also needs to be explored. Further, along with the curative approach, which has been our focus since long, we should pay attention to the preventive aspect too by generating community awareness about cataracts, its symptoms, and the importance of regular screening to effectively control blindness in the long run. This may be especially true for countries with developing economies, including India, that already have a huge burden of existing blindness, and currently are in a demographic transition to aging.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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