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A CROSS-SECTIONAL STUDY ON VISUAL OUTCOME AFTER CATARACT SURGERY IN NORTHERN INDIA: AN INDIAN PERSPECTIVE

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ABSTRACT

Purpose: *The main purpose of this study is to determine the visual outcomes and satisfaction among the old age patients after cataract surgery in Northern India.*

Methodology: *It was a cross sectional study conducted to estimate the visual outcomes after cataract surgery. It includes 9023 (mean age: 55±2.51) participants (Male-4848 & Female-4175). The participants underwent a comprehensive eye examination and information on the patient's lifestyle, chief complaints, socioeconomic status, occupations; systemic diseases were collected using a self-structured questionnaire. The included data were analyzed to explore the visual outcomes and patient's satisfaction using the Pearson Chi-square test for each factor through SPSS version 21.*

Results: *Out of 9023 individuals enrolled in the study, 6370 were diagnosed having cataract (a vast majority of patients had cortical cataract (66.2%), followed by nuclear (27.1%) and a small number (6.6%) of posterior subcapsular cataract) and 3372 were found fit for cataract surgery. However only 3156 patients underwent surgery. A vast majority of the patients (80.8%) with the best correction achieved a good visual outcome, followed by a borderline visual outcome (12.9%). Poor visual outcome was seen only in 6.4% cases.*

All parameters were found to be statistically significant with the Pearson Chi-square test. A p-value of <0.05 was considered as significant.

Conclusion: *WHO criteria fulfilled the visual outcome after cataract surgery in this study. In this study, age, surgical methods, ocular co-morbidities, pre and post-operative complications were associated with a poor visual outcome i.e. 6.4%.*

KEYWORDS: *Visual Outcome, Cataract Surgery, Eye-Care, Optometry, Public Health*

INTRODUCTION

In many nations, including India, visual impairment and blindness are public health issues. The most widely recognized cause of blindness is cataract, followed by glaucoma, diabetic retinopathy, refractive errors, conjunctivitis, and childhood blindness (WHO).

Worldwide, visual impairment is a significant financial burden: The World Health Organization estimates that vision impairment costs $411 billion annually in lost production (WHO, 2022).

According to recent global data, 82% of people who are blind and 65% of people who are visually impaired are over the age of 50. The two most common causes of visual impairment, according to the WHO (WHO, 2022) are cataracts (33%), and uncorrected refractive errors (43%)

Near- or far-sightedness affects at least 2.2 billion people around the world. One billion, or nearly half of these cases, involved visual loss that either needed to be corrected or could have been avoided.

As part of the global initiative VISION 2020, WHO is collaborating closely with member states and partners to eliminate preventable causes of blindness by developing and implementing comprehensive national eye care.

The Expert Group on Sight Loss conducted research and found that very significant progress had been made by 2010, when the number of blind people had decreased to 32 million. The age-specific prevalence decreases of 42% was even more significant, demonstrating that we can make a significant difference by following our instincts. The site WHO fostered a worldwide activity plan in 2013 proposing to lessen preventable visual deficiency by 25% by 2019 (WHO, 2022).

Age-related or senile cataract is the leading cause of adult visual impairment worldwide (65%). Depending on the availability of ophthalmic services, affordability, and the general public's knowledge of the field, causes can vary greatly from country to country. Contrasted with big league salary nations, the extent of visual weakness brought about by cataract is higher in low- and center pay countries. In countries with high incomes,

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glaucoma and age-related macular degeneration (ARMD) are more common. Genet, 2022).

A significant global issue of the 21st century is cataract (NPCB, DGH, MFFW, Government). India in 2019). In India, cataracts are responsible for 66.2% of adult blindness, 80.7% of severe visual impairment, and 70.2% of moderate visual impairment. Expanding individuals' age, they are bound to get cataracts. As the world's population ages, cataract-related blindness and vision loss are rising (Fatoye, 2021).

A cataract is a condition in which the transparency and opacity of the lens decrease. The most common cause of preventable blindness and visual impairment worldwide is cataracts.

Treatment of cataract comprises of its careful evacuation. The normal surgeries used to treat cataract are intracapsular cataract extraction (ICCE) and extracapsular cataract extraction (ECCE). Be that as it may, certain non-careful measures might be useful until cataract surgery is performed.

The technical procedures of cataract surgery have improved over the past ten years as a result of a variety of changes and advancements. This has resulted in the switch from traditional intracapsular cataract extraction to small incision cataract surgery and phacoemulsification with the implantation of an intraocular lens (IOL). There are benefits and drawbacks to each method of surgery, and the success of cataract surgery depends on which method is used. The choice of the appropriate method determines the outcome of cataract surgery. The surgeon's skill and level of comfort are all factors that influence the choice of technique (Matta et al., 2016).

Despite numerous technological advancements, the clinical outcomes of cataract surgery in low- and middle-income countries (LMICs) range from 11.4% to 44%, which is substandard. Only a few of these studies focused on metropolitan areas, while the majority of them included rural areas or a mix of urban and rural residents. Not many of these investigations were metropolitan, while the larger part included rustic regions or a blend of metropolitan and provincial occupants. Due to India's size and significant regional disparities in treatment and outcomes, both regional and national plans and programs are required to improve the outcomes of cataract surgery and provide community-specific ophthalmic services. Matta and others, 2016).

There are no methodical examinations in the accessible writing for northern India that correlatespecificrisk factors with visual outcome after a cataract surgery to accomplish 100 percent visual outcomes.

Age-related or senile cataract is the leading cause of adult visual impairment worldwide (65%). Depending on the availability of ophthalmic services, affordability, and the general public's knowledge of the field, causes can vary greatly from country to country. Contrasted with big league salary nations, the extent of visual weakness brought about by cataracts is higher in low- and center pay countries. In countries with high incomes,

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Treatment of cataract comprises of its careful evacuation. The normal surgeries used to treat cataracts are intracapsular cataract extraction (ICCE) and extracapsular cataract extraction (ECCE). Be that as it may, certain non-careful measures might be useful until cataract surgery is performed.

The technical procedures of cataract surgery have improved over the past ten years as a result of a variety of changes and advancements. This has resulted in the switch from traditional intracapsular cataract extraction to small incision cataract surgery and phacoemulsification with the implantation of an intraocular lens (IOL). There are benefits and drawbacks to each method of surgery, and the success of cataract surgery depends on which method is used. The choice of the appropriate method determines the outcome of cataract surgery. The surgeon's skill and level of comfort are all factors that influence the choice of technique (Matta et al., 2016).

The clinical outcomes of cataract surgery in low- and middle-income countries (LMICs) range from 11.4% to 44%, which is substandard despite all the technical developments. Most of these studies included rural areas or a mix of urban and rural residents, while only a few focused on metropolitan areas. Few of these studies were urban, while the majority featured rural areas or a mix of urban and rural inhabitants. Regional and national plans and programs are required in India to provide community-specific ophthalmic services and enhance the outcomes of cataract surgery because of the nation's size and the significant regional inequalities in treatment and outcomes. (Matta et al., 2016).

There are no systematic studies in the available literature for northern India that correlate specific risk factors with visual outcomes after cataract surgery to achieve 100% visual outcomes.In attempting to address the lacunae in available information. I took up the study titled “risk factors for poor Visual Outcome of cataract surgery in rural and urban population of Central Uttar Pradesh”

METHODOLOGY

The study was conducted at Era Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, from January 2019 to July 2022 after obtaining prior institutional ethical clearance from Era University and advertising informed consent forms to the participants enrolled in the study. Because of the paucity of

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data-based comparative evaluation of post-cataract surgery visual outcome; cataract surgical coverage (CSC); age-specific cataract surgical rate (CSR) in Uttar Pradesh in available literature; work was taken up with the aim to assess and evaluate the risk factors for post-surgery visual outcome in senile cataract among urban and rural population in Central Uttar Pradesh. The study design is Observational, Analytic, and longitudinal study. Adult patients in the age group50 years and above regardless of gender and population background (urban/rural); having senile cataract and have been operated in the department of ophthalmology Era Lucknow Medical College, Lucknow.A standard pretest questionnaire on the patient's demographic profile and degree of visual handicap was administered.

In this review, measurable dissects were performed utilizing SPSS (Factual Bundle for Sociologies) IBM Corp. Delivered 2017. Version 23.0 of IBM SPSS Statistics for Windows. NY, Armonk: IBM Corporation - All analyses were tested using two-sided hypothesis tests, and a p value of less than 0.05 was assumed to indicate significance. The statistical hypothesis was tested using the chi-square (2) test.

RESULTS

The findings of present study are based on the observation made on 9023 individuals enrolled in the study. The study duration was three and half years, spanning from January 2019 to July 2022. The subjects were recruited to the study after obtaining the IEC approval from Era University. Ensuring the voluntary participation of subjects in the study after advertising inform consent forms. Of 9023 individuals enrolled in the study, 6370 were diagnosed having cataract and 3372 were found fit for cataract surgery. However only 3156 patients underwent surgery (Fig1).

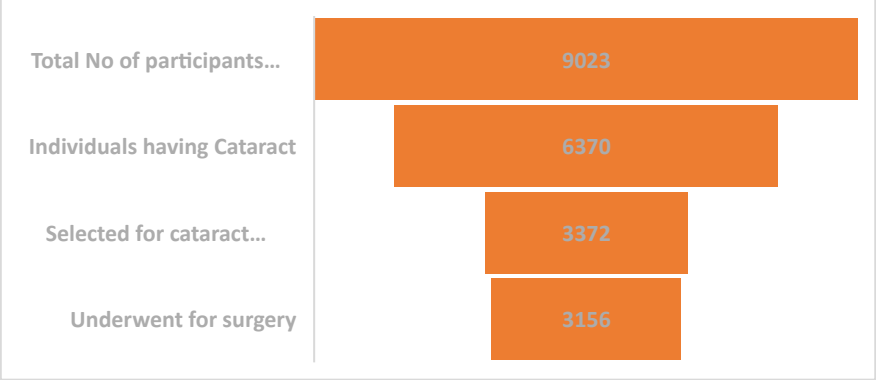


Figure 1

Out of total 6370 participants of cataract, a vast majority of patients had cortical cataract (66.2%), followed by nuclear (27.1%) and a small number (6.6%) of posterior subcapsular cataracts (fig 2).

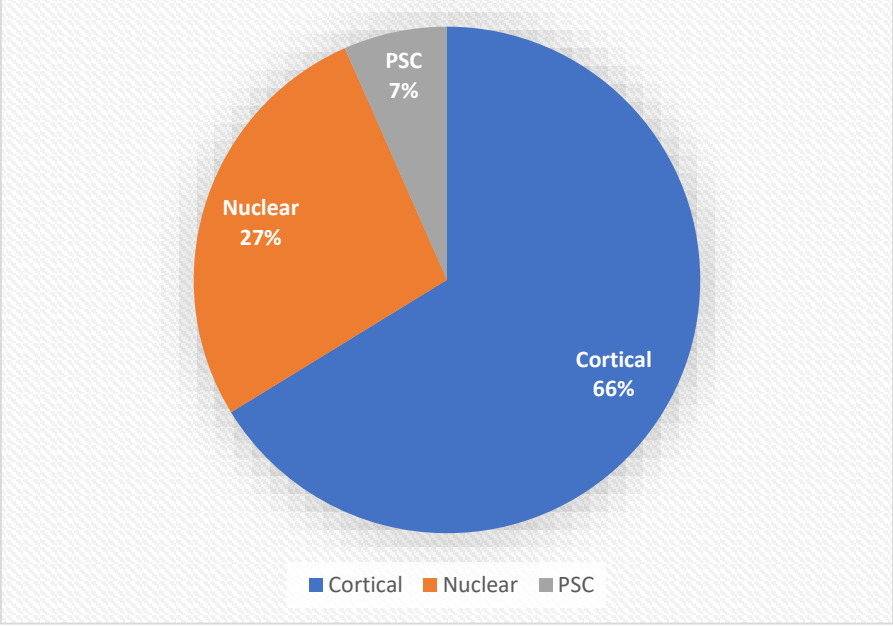


Fig: 2: Clinical presentation of cataract among the study subject

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A. SOCIO-DEMOGRAPHIC PROFILE

All the subjects enrolled in the study were adults the age of 50 years or above, regardless of gender and demographic settings. Out of the total 9023 enrolled in the study, only 3348 (37.1%) were from rural while 5675 (62.9%) were from urban backgrounds. The urban population outnumbered the rural population, probably because of the urban setting of the place of study. Overall gender distribution showed male (4848) subjects outnumbered female (4175) subjects enrolled in the study. A similar pattern of gender distribution is reflected in both rural and urban participant populations individually (Table 4.1).

The majority of the participant was aged 50-60 years (7015), and as the age group advanced number of participants was reciprocally proportional. The majority of subjects enrolled in the study from the urban areas reported comparatively at a younger age in contrast to those from rural backgrounds. Most of the subjects from the urban areas were aged between the ages 50-60 years, while the subjects from the rural areas were between age 60-80 (Table 4.1).

The working background of the 9023 individuals was almost evenly distributed; 4784 (53%) worked indoors, while 4239 (47%) worked outdoors. Working hours of eight hours or more per day in a particular environment were taken as criteria for labeling an individual as an indoor and outdoor worker. Analysis revealed that a smaller number of indoor workers (46.9%) were from rural areas compared to those from urban areas (53.1%). Among those subjects working outdoors, 26.1% were from rural areas, and 73.9% were from urban areas (Table 4.1).

The majority of the participants (80%) did not have any history of addiction. Only 12% consumed smokeless tobacco (nonsmokers) products, 7% were habitual smokers, and 1% to alcohol (Table 4.1). Addiction was more common in the participants from rural backgrounds. All the alcoholics and smokers were from rural areas, along with the tobacco chewers (57.4%) (Table 4.1).

Most of the participants enrolled in the study belonged to the upper socioeconomic class (72%), followed by the lower (18%) and middle class (10%). When the urban and rural background was further elaborated, it revealed that in the upper socioeconomic group, the majority of the patients were from urban areas (87.3%), while all the participants from rural backgrounds were from middle and lower socioeconomic classes (100%) (Table 4.1).

The majority of the participants were free of any associated systemic disease (80.7%), and only a small percentage of them had Diabetes Mellitus (DM) (8.8%), hypertension (HTN) (8.4%), DM with HTN (0.6%) and others (1.6%). Patients with systemic diseases were mainly from rural backgrounds (Table 4.1).

The majority of participants were free of any other ocular diseases (90.9%). Associated ocular diseases among participants included diabetic retinopathy (DR) (6%), hypertensive retinopathy (HTR) (1.5%), and others (1.6%) (Table 4.1).

Table 4.1: Sociodemographic profile of participant enrolled in the study

Sociodemographic profile	Background		Total
	Rural	**Urban**	
Gender			
Female	1656	2519	4175
	39.7%	60.3%	100.0%
Male	1692	3156	4848
	34.9%	65.1%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%
Age			
50-60	1980	5035	7015
	28.2%	71.8%	100.0%
61-70	1018	434	1452
	70.1%	29.9%	100.0%
71-80	328	164	492
	66.7%	33.3%	100.0%
81-90	22	42	64
	34.4%	65.6%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%
Occupation			
Indoor	2243	2541	4784
	46.9%	53.1%	100.0%
Outdoor	1105	3134	4239
	26.1%	73.9%	100.0%
Total	3348	5675	9023

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	37.1%	62.9%	100.0%
Addiction			
None	1998	5224	7222
	27.7%	72.3%	100.0%
Alcohol	117	0	117
	100.0%	0.0%	100.0%
Smoking	626	0	626
	100.0%	0.0%	100.0%
Tobacco	607	451	1058
	57.4%	42.6%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%
Socioeconomic Status (SES)			
Upper Class	822	5675	6497
	12.7%	87.3%	100.0%
Middle Class	940	0	940
	100.0%	0.0%	100.0%
Lower Class	1586	0	1586
	100.0%	0.0%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%
Associated Systemic Disease (ASD)			
Nil	1616	5663	7279
	22.2%	77.8%	100.0%
DM	794	2	796
	99.7%	.3%	100.0%
HTN	748	6	754
	99.2%	.8%	100.0%
DM+HTN	50	0	50
	100.0%	0.0%	100.0%
Others	140	4	144
	97.2%	2.8%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%
Associated eye disease (AED)			
Nil	2538	5667	8205
	30.9%	69.1%	100.0%
DR	530	8	538
	98.5%	1.5%	100.0%
HTR	134	0	134
	100.0%	0.0%	100.0%
Others	146	0	146
	100.0%	0.0%	100.0%
Total	3348	5675	9023
	37.1%	62.9%	100.0%

B. POST OPERATIVE VISUAL OUTCOME

Following cataract surgery at 6-week follow-up, based on presenting visual acuity(PVA), a vast majority of the patients (80.8%) with the best correction achieved a good visual outcome, followed by a borderline visual outcome (12.9%). Poor visual outcome was seen only in 6.4% cases. This result was statistically significant ($p<0.001$) (Table 4.38).

Table 4.38: Post-operative Visual Outcome after cataract surgery

Visual Outcome		
Good (0)	2549	80.8
Borderline (1)	406	12.9
Poor (2)	201	6.4
Total	3156	100.0

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1. Post operative visual outcome vs. Population background

Over all post-operative visual outcome in the study group individuals was good, regardless of their background (urban and rural). However, the cases with poor outcome were more in the rural population in comparison to the urban group (8.1% rural and 0.3% urban). This result was also statistically significant (p=0.001) (Table 4.39).

Table 4.39: Post-surgical visual outcome among population background

Background	Visual Outcome			Total	p value
	Good	**Borderline**	**Poor**		
Rural	1938	310	199	2447	<0.001
	79.2%	12.7%	8.1%	100.0%	
Urban	611	96	2	709	
	86.2%	13.5%	0.3%	100.0%	
Total	2549	406	201	3156	
	80.8%	12.9%	6.4%	100.0%	

2. Visualoutcomevs Patients Age

Post-operativevisualoutcome, though good in majority of the cases yet, declinedsignificantlywithincreasingage.Thebestoutcomewasachievedintheagegroup of50-60and 61-70 years of age(Table 4.40). This result is statistically significant (p<0.001)

Table 4.40:Postoperativevisualoutcome Vs. patient'sage.

Age	Visual Outcome			Total
	Good	**Borderline**	**Poor**	
50-60	1534(86.1%)	84(4.7%)	164(9.2%)	1782
61-70	895(87.6%)	98(9.6%)	29(2.8%)	1022
71-80	114(34.5%)	210(63.6%)	6(1.8%)	330
81-90	6(27.3%)	14(63.6%)	2(9.1%)	22
Total	2549(80.8%)	406 (12.9%)	201(6.4%)	3156

Majority of the cases with borderline and poor post operative visual outcomes were from rural population compared to the urban population and in the older age group. In the urban population, no poor outcome was seen in the age group of 50-60 and 61-70 years of age groups, while in the rural population, 11.5% of 50–60-year-olds and 3.7% of 61–70-year-olds had a poor outcome (Table 4.41). This result was also statistically significant (p<0.001).

Table 4.41: Post-operative visual outcome population background vs. age.

Population			Visual outcome			Total	P value
			Good	**Borderline**	**Poor**		
Rural	**Age**	**50-60**	1185	76	164	1425	<0.001
			83.2%	5.3%	11.5%	100.0%	
		61-70	685	68	29	782	
			87.6%	8.7%	3.7%	100.0%	
		71-80	66	158	4	228	
			28.9%	69.3%	1.8%	100.0%	
		81-90	2	8	2	12	
			16.7%	66.7%	16.7%	100.0%	
	Total		1938	310	199	2447	
			79.2%	12.7%	8.1%	100.0%	
Urban	**Age**	**50-60**	349	8	0	357	<0.001
			97.8%	2.2%	0.0%	100.0%	
		61-70	210	30	0	240	
			87.5%	12.5%	0.0%	100.0%	
		71-80	48	52	2	102	
			47.1%	51.0%	2.0%	100.0%	
		81-90	4	6	0	10	
			40.0%	60.0%	0.0%	100.0%	
	Total		611	96	2	709	
			86.2%	13.5%	.3%	100.0%	

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Controlled systemic comorbidities did not have any effect on post-surgical visual outcomes regardless of the age of the patients (Table 4.42)

3. Gender based analysis of the post-operative visual outcome

Overall good post-operative visual outcome was almost the same in both sexes (males 84.6%; females; 76.9%). Poor outcomes were noted in male gender (male;7.9%,female,4.8%) and this result was statistically significant (p<0.001) (Table 4.43).

Table 4.43: Gender based analysis of the post-operative visual outcome

Gender	Visual Outcome			Total	p value
	Good	**Borderline**	**Poor**		
Female	1331(84.6%)	166(10.6%)	76 (4.8%)	1573	<0.001
Male	1218(76.9%)	240(15.2%)	125(7.9%)	1583	
Total	2549(80.8%)	406(12.9%)	201(6.4%)	3156	

Correlation of gender-based Post operative visual outcome with the population demographics

Good visual outcome was observed to be of similar proportions for the females in both urban and rural populations (84.5%and86.4).Majority of the cases with poor visual outcome were restricted to the rural population males (12.2%). The result was statistically significant (p<0.001). In the urban population, no significant difference is noted in visual outcome of two sexes (Table 4.44). The result was not statistically significant (p<0.795).

Table 4.44: Correlation of gender-based Post operative visual outcome with the population demographics

Background		Visual Outcome			**Total**	**P value**
		Good	**Borderline**	**Poor**		
Rural	**Female**	1217	148	76	1441	<0.001
		84.5%	10.3%	5.3%	100.0%	
	Male	721	162	123	1006	
		71.7%	16.1%	12.2%	100.0%	
	Total	1938	310	199	2447	
		79.2%	12.7%	8.1%	100.0%	
Urban	**Female**	114	18	0	132	<0.795
		86.4%	13.6%	0.0%	100.0%	
	Male	497	78	2	577	
		86.1%	13.5%	.3%	100.0%	
	Total	611	96	2	709	
		86.2%	13.5%	.3%	100.0%	
Total	**Female**	1331	166	76	1573	
		84.6%	10.6%	4.8%	100.0%	
	Male	1218	240	125	1583	
		76.9%	15.2%	7.9%	100.0%	
	Total	2549	406	201	3156	
		80.8%	12.9%	6.4%	100.0%	

4. Visual Outcome vs. Socioeconomic Status

Over all post operative visual outcome is good regardless of socioeconomic status of the individuals. No significant difference was observed in groups with in borderline vision outcomes irrespective of the socioeconomic status. However, patients with poor visual outcome were from middle socioeconomic status group (22.2%). The result was statistically significant (p<0.001) (Table 4.46).

Table 4.46: Visual outcome in socioeconomic status

Socio-Economic Status (SES)	Visual Outcome			Total	p value
	Good	**Borderline**	**Poor**		
Upper (1)	708(86.6%)	106(13.0%)	4(0.5%)	818	<0.001
Middle (2)	531(61.7%)	138(16%)	191(22.2%)	860	
Lower (3)	1310(88.6%)	162(11%)	6(0.4%)	1478	
Total	2549	406	201	3156	

Amongst the rural population good visual outcome was seen in majority of cases regardless of socioeconomic status (upperclass:89%,middleclass:61.7%,lowerclass:88.6%), a borderline and poor outcome was noted more middle-class rural population. The result was statistically significant (p<0.001). In the urban population, all cases belonged to the upper-class

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socioeconomic status, and the majority of them (86.2%) obtained a good post-operative visual result, followed by a borderline visual result (13.5%) and only 0.3% of the subjects enrolled in the study were endowed with a poor visual outcome (Table 4.47). Thus, living background, rural or urban, vis a vis socioeconomic status did not seems to influence the post operative visual outcome.

Table 4.47: Visual outcome vs. socioeconomic status in population background

Population			Visual Outcome			Total	P value
			Good	Borderline	Poor		
Rural	**SES**	**Upper class**	97	10	2	109	<0.001
			89.0%	9.2%	1.8%	100.0%	
		Middle class	531	138	191	860	
			61.7%	16.0%	22.2%	100.0%	
		Lower class	1310	162	6	1478	
			88.6%	11.0%	0.4%	100.0%	
	Total		1938	310	199	2447	
			79.2%	12.7%	8.1%	100.0%	
Urban	**SES**	**Upper Class**	611	96	2	709	
			86.2%	13.5%	0.3%	100.0%	
	Total		611	96	2	709	
			86.2%	13.5%	0.3%	100.0%	

5. Visual outcome vs. Work environment

Post operative visual outcome was good in almost same ratio regardless of work environment (80.5% indoor workers, 81.4% outdoor workers). Poor outcome was comparatively more in indoor workers than in outdoor workers (8.1%and2.7%, respectively). The result is statistically significant (p<0.001)(Table 4.48).

Table 4.48: Post-operative visual outcome in work environment.

Working Environment (WE)	Visual Outcome			Total	p value
	Good	**Borderline**	**Poor**		
Indoor	1738(80.5%)	248(11.5%)	174(8.1%)	2160	<0.001
Outdoor	811(81.4%)	158(15.9%)	27(2.7%)	996	
Total	2549(80.8%)	406(12.9%)	201(6.4%)	3156	

In the rural population, there was no difference in good vision outcomes with regard to the work environment, but there was a significant difference amongst patients with poor vision outcomes (outdoors;3.2%,indoors;10.7%), and this result was statistically significant (p<0.001).

In the urban population, visual outcome was good in majorityof the cases regardless of work environment. There were only few cases with poor visual outcome result (0.4%), and this result was not statistically significant (p<0.524).

Amongst indoor workers the majority of the cases with poor outcome belonged to rural milieus compared to urban settings. There was no poor visual outcome result was found in the urban settings (Table 4.49).

Table 4.49: Post operative visual outcome in work environment and population background.

Population			Visual outcome			Total	P value
			Good	**Borderline**	**Poor**		
Rural	**WE**	**Indoor**	1256	176	172	1604	<0.001
			78.3%	11.0%	10.7%	100.0%	
		Outdoor	682	134	27	843	
			80.9%	15.9%	3.2%	100.0%	
	Total		1938	310	199	2447	
			79.2%	12.7%	8.1%	100.0%	
Urban	**WE**	**Indoor**	482	72	2	556	<0.524
			86.7%	12.9%	0.4%	100.0%	
		Outdoor	129	24	0	153	
			84.3%	15.7%	0.0%	100.0%	
	Total		611	96	2	709	
			86.2%	13.5%	0.3%	100.0%	

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6. Visual outcome vs. Addiction

Post-operative visual outcome did not seem to be affected in patients who consumed alcohol (84.1%) and smokeless tobacco product users (85.2%) but is significantly poor in smokers (41%)(p=0.000) (Table 4.50).

Table 4.50: Visual outcome among addicted

Addiction	Visual Outcome			Total	p value
	Good	**Borderline**	**Poor**		
No	1793(80.8%)	218(10.8%)	8(0.4%)	2018	<0.000
Alcohol	74(84.1%)	8(9.1%)	6(6.8%)	88	
Smoking	162(36.9%)	97(22.1%)	180(41.0%)	439	
Tobacco	520(85.2%)	83(13.6%)	7(1.1%)	611	
Total	2549(80.8%)	406(12.9%)	201 (6.4%)	3156	

Pattern of proportion of poor visual outcome cases amongst Smokeless tobacco product consumers, smokers, alcoholics was almost similar in addicts from either rural or urban settings(Table 4.51)

7. Visual outcome vs systemic diseases

Over all post- operative visual outcome in cases with associated controlled systemic diseases was good. The result was statistically significant (p<0.001) (Table 4.52).

Table 4.52: Post-Operative Visual Outcome in Systemic Diseases

SD	Visual Outcome			Total
	Good	**Borderline**	**Poor**	
Nil	1176	192	186	1554
	75.7%	12.4%	12.0%	100.0%
DM	637	67	0	704
	90.5%	9.5%	0.0%	100.0%
HTN	613	91	15	719
	85.3%	12.7%	2.1%	100.0%
DM & HTN	32	10	0	42
	76.2%	23.8%	0.0%	100.0%
Other	91	46	0	137
	66.4%	33.6%	0.0%	100.0%
Total	2549	406	201	3156
	80.8%	12.9%	6.4%	100.0%

In patients having any controlled comorbid risk factors, post-operative visual outcome was good regardless of population demographics. The result is statistically significant (p<0.001) (Table 4.53).

Table 4.53: Post-Operative Visual Outcome in patients with comorbidities residing urban and rural settings

Background	SD	Visual Outcome			Total	P value
		Good	**Borderline**	**Poor**		
Rural	**Nil**	882	160	186	1228	<0.001
		71.80%	13.00%	15.10%	100.00%	
	DM	497	53	0	550	
		90.40%	9.60%	0.00%	100.00%	
	HTN	469	65	13	547	
		85.70%	11.90%	2.40%	100.00%	
	DM & HTN	25	10	0	35	
		71.40%	28.60%	0.00%	100.00%	
	Others	65	22	0	87	
		74.70%	25.30%	0.00%	100.00%	
	Total	1938	310	199	2447	
		79.20%	12.70%	8.10%	100.00%	
Urban	**Nil**	294	32	0	326	<0.001
		90.20%	9.80%	0.00%	100.00%	
	DM	140	14	0	154	
		90.90%	9.10%	0.00%	100.00%	
	HTN	144	26	2	172	

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		83.70%	15.10%	1.20%	100.00%	
	DM & HTN	7	0	0	7	
		100.00%	0.00%	0.00%	100.00%	
	Others	26	24	0	50	
		52.00%	48.00%	0.00%	100.00%	
	Total	611	96	2	709	
		86.20%	13.50%	0.30%	100.00%	

8. Visual Outcome in Associated Eye Diseases

Post-cataract surgery visual outcome does not seem to be affected by any associated eye disease (Table 4.54), probably because there was no or minimal involvement of retina- the neurosensory layer of eye. This finding was similar regardless of the patients demographic setting and this result was statistically significant (p=0.001) (Table 4.54).

9. Visual Outcome vs. Types of Cataracts

Post-surgical visual outcome was significantly good in nuclear (89.6%) and posterior subcapsular (88.1%) cataract types, with the exception of cortical cataract (73.4%). Poor outcome was more frequently observed in patients with cortical cataract (11.3%) than in nuclear (0.5%) or posterior subcapsular cataract (1.4%)(Table 4.56).

This is explained by the fact in cases of nuclear and PSC the lenticular opacity was in line of visual axes, the effect on vision is more pronounced and more distressing to patients as compared to that in cases of cortical cataract where lenticular opacity being diffusely distributed in whole of the lens cortex. Thiscauses blurring of vision, hence post operatively the clarity of the vision experienced by the individual is much better in cases who had nuclear cataract or PSC compared to those who had cortical cataract.

Table 4.56: Visual Outcome in types of cataracts.

Type of Cataract	Visual Outcome			Total
	Good	**Borderline**	**Poor**	
Cortical	1234(73.4%)	257(15.3%)	190(11.3%)	1681
Nuclear	944(89.6%)	105(10%)	5(0.5%)	1054
Posterior Subcapsular	371(88.1%)	44(10.5%)	6(1.4%)	421
Total	2549	406	201	3156

10. Post-surgical visual outcome vs. Type of surgery

A good post operative visual outcome result was observed in SICS (87.7%) as well as phacoemulsification (69.4%). Surgery cases with borderline poor visual outcome cases were more common in phacoemulsification (16.1% and 14.5%) compared to SICS (10.9% and 1.4%) surgery group. (Table 4.58).

Table 4.58: Post Operative Visual Outcome in types of surgery.

Type of surgery	Visual Outcome			Total
	Good	**Borderline**	**Poor**	
Phaco	830 (69.4%)	193(16.1%)	173(14.5%)	1196
SICS	1719(87.7%)	213(10.9%)	28(1.4%)	1960
Total	2549	406	201	3156

DISCUSSION

In the present study, post-cataract surgery visual outcome results were good in the majority of the cases in all populations, regardless of demographic settings. (urban and rural). The poor visual outcome cases occurred mainly in the rural population (8.1% rural and 0.3% urban), and this result was statistically significant (p<0.001). This finding is in accord with a previous study conducted in Andhra Pradesh, in which a higher proportion of subjects in urban areas had a good score than in rural areas (77.6% vs. 70.6%; p<0.001) (Marmamula S. et al., 2016). There is an association between population background and visual outcome, with rural background population being a risk factor for poor outcome (OR 1.6, CI 1.2-2.0, p<0.001). With no specific explanation, this may be attributed mainly to the rural population's environmental factors and poor dietary habits.

Postoperative visual outcome decreased significantly with increasing age. The best outcome was achieved in the age group of 50-70 years, while the majority of borderline visual outcomes were in the age group of 71-90 years, and the majority of poor outcomes were in the still higher age group of 81-90 years. In contrast to the older age group in the urban population, the bulk of borderline and poor results were in the rural population. While the visual outcomes of the population in the corresponding age groups were positive, 11.5% of 50 to 60-year-olds and 3.7% of 61 to 70-year-olds in the rural population had bad outcomes. This finding was statistically significant (p 0.001).

There is a strong association between age and postoperative visual outcome, as increasing age decreases the likelihood of a good outcome (61-70; OR 0.8 CI, 0.6-1.1, p=0.265, 71-80; OR 11.72, CI 9.0-42.5, p<0.001, 81-90; OR 16.49, CI 6.3-42.5, p<0.001). Previous studies conducted in India (Dandona L et

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al., 1999; Murthy GV et al., 2001; Thulasi raj R.D. et al., 2002; Vijaya L et al., 2002; Nirmalan PK et al., 2002; Khanna RC et al., 2003) support the findings of the present study that increasing age is a risk factor for post-surgical poor outcome.

In the present study, the overall postoperative visual outcome in the majority of the cases was good, regardless of gender. However, in patients with a poor visual outcome group, the male gender outnumbered the female gender (male; 7.9%, female, 4.8%), and this result was statistically significant (p<0.001). The good visual outcome was in similar proportion for the female sex in both urban and rural populations (84.5% and 86.4%). Most of the cases with poor outcomes were males from the rural population (male; 12.2%, female; 5.3%). The result is statistically significant (p=0.000). In the urban population, no significant difference was noted in the visual outcome of the two sexes. The finding was not statistically significant (p=0.795), and this is akin to other studies (Marmamula S et al., 2016).

There is an association between gender and visual outcome. The male gender is at a 1.6 times higher risk of developing cataracts compared to females (OR was 1.6, CI 1.2-2.0 p<0.001). As in other studies, Gogate et al., 2011 and Venkatesh et al.,2005 found a good outcome in female patients. (Gogate P et al 2011, Venkatesh R, 2005)

In their study, Yan X, Guan C, et al. 2013 and Hashemi H et al. 2012 found females gender at high risk for poor visual outcomes. This finding is contrary to observations made in our study. In another study conducted in the Indian state of Rajasthan, women (74%) were more prone to have poor visual outcomes after cataract surgery than men (62%), and people living in rural areas (73%) in comparison to those living in the urban areas (52%) (Murthy GVS et al., 2001). It is likely that females were studied at a later time point than males and had a poorer clinical presentation of cataracts, masking pre-existing ocular comorbidity/condition, thereby impacting the visual outcomes.

Considering postoperative visual outcome as the key finding, in the group of cases with good visual outcomes, socioeconomic status did not seem to have any influence on the result. There was no significant difference between borderline vision outcomes, but in poor vision outcomes group cases, there was a significant difference in the middle class (upper class; 0.5%, middle class; 22.2%, lower class; 0.4%), and this result was statistically significant (p<0.001). Good vision scores were more frequent in the upper and lower classes than in the middle class (upper class: 89%, middle class: 61.7%, lower class: 88.6%), borderline and poor scores were found more frequently in the middle class of the rural population, and this result too was statistically significant (p<0.001). In the urban population, all cases belonged to the upper class, and the majority of them (86.2%) obtained a good visual result, followed by a borderline visual result (13.5%), and only 0.3% with a poor result. This result was statistically significant (p<0.001).

To some extent, socioeconomic status is a risk factor for postoperative visual outcomes. In middle-class families, the visual outcome was worse than in upper-class families (OR 3.9, CI 3.1-5.0, p<0.001). In the Andhra Pradesh Eye Disease Study in India, individuals with a monthly per capita income of ⩽US$4.5 had a fivefold higher risk of having a very poor visual outcome after cataract surgery (presenting visual acuity <6/60) than persons with a monthly per capita income of > US$4.5 (Dandona L et al., 1999).

A vast proportion of cases with good and borderline vision were similar in indoor and outdoor workers, whereas poor outcome was more common among indoor workers than outdoor workers (8.1% and 2.7%, respectively). In the rural population, there was no difference in good vision outcomes (indoor; 78.3%, outdoor; 80.9%) with regard to the work environment, but there was a significant difference among patients with poor visual outcomes of outdoor and indoor (outdoors; 3.2%, indoors; 10.7%), and this result was statistically significant (p<0.001). In the urban population, a good visual outcome result was obtained in the majority of cases, followed by a borderline visual result. There were only a few cases with poor visual outcome results (0.4%), and this result is not statistically significant (p<0.524). Amongst the indoor worker, 's majority of the cases with poor outcomes were in the rural population compared to the urban population. No poor visual outcome result was found in the urban population; good and borderline visual outcomes were found in outdoor workers as in both groups. Work environment does not seem to be a risk factor for the post-surgical visual outcome (OR 0.939, p<0.524).

In the present study, the visual outcome was significantly poor in smokers (41%) (p<0.001). There was a significant difference in postoperative visual outcome in smokers (35.1%) compared to non-smokers (89.3%). This result was statistically significant (p<0.001). Overall, in the urban population, the visual outcome result was like the rural population in terms of good visual outcomes. Smokers from the urban population had a borderline visual outcome (41.2%), while a vast majority of those from the rural population had a poor visual outcome (44.4%). Smoking and alcohol were the risk factors for postoperative visual outcomes. The risk for poor postoperative visual outcome was 13.5 times higher in smokers compared to non-smokers (OR 13.5 CI 10.6-17.2, p<0.000) and 1.5 times higher in alcoholics (OR 1.5, CI 0.8-2.7, p<0.176) (Table 4.63).

Postoperative visual outcomes are significantly good in all systemic conditions regardless of the population background of commonly associated systemic diseases. The result is statistically significant (p<0.001). Controlled systemic comorbidities were not a risk factor for post-surgical borderline poor outcome (OR < 1). The rate of successful cataract surgery in the study population ACCORD was 67%. This shows that diabetic people currently have a relatively positive visual prognosis following cataract surgery. Studies have reported that 62% to 89% of people with diabetes achieve a good visual outcome (Cunliffe IA et al., 1991, Wagner T et al., 1996, Antcliff RJ et al., 1996, Somaiya MD et al., 2002). However, most of these studies included samples of fewer than 200 subjects, were more than 15 years old, and were conducted at a single institution. In contrast, this study involved a large sample

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of a more recent population from multiple United States and Canadian centers. The visual outcomes, however, were comparable to those that had already been reported, which could be due to a number of factors. First, variations in patient characteristics, especially in the prevalence and severity of diabetic retinopathy between cohorts, are likely to have an impact on the visual results (Ostri C et al. 2011, **Liu L** et al. 2018). Due to slowed wound healing, an increase in infections, and a higher risk of developing diabetic retinopathy in diabetic patients, glycemic management is frequently a problem (**Rayfield EJ** et al. 1982; **Brem** H et al. 2007). These patients might benefit from putting more of an emphasis on postoperative follow-up, and it's important to take into account how social factors may affect visual outcomes. Visual outcome stays significantly good even in the presence of controlled or treated associated ocular diseases regardless of population background. Controlled ocular diseases are not a risk factor for postoperative visual outcome (OR>1).

Out of the total of 6370 participants with cataracts, the majority of patients had cortical cataracts (66.2%), followed by nuclear (27.1%) and a small number (6.6%) of posterior subcapsular cataracts. Phaco was performed in 1196 (37.8%), while SICS was used in 1960 (62.1%). Both Phaco as well as SICS were taken up in all types of cataracts, but in nuclear cataracts, SICS was the surgery of choice (88.5%). Postoperative visual outcome was significantly good in nuclear (89.6%) and posterior subcapsular (88.1%) cataract types, with the exception of cortical cataracts (73.4%). Poor visual outcomes were observed in cortical cataracts (11.3%) and only in 0.5% of cases of nuclear cataracts and posterior subcapsular cataracts (1.4%). These findings can be well explained because the maximum number of cases operated were of cortical cataracts, and hence, pitfalls are likely to be more in the same group. The clinical presentation of cataracts is not a risk factor for postoperative visual outcome (OR<1).

A percentage of good visual outcomes was observed in the majority of cases at SICS (87.7%) compared to phacoemulsification (69.4%). Borderline or poor visual outcome was more common with phacoemulsification (16.1% and 14.5%) compared to SICS (10.9% and 1.4%). This type of surgery was not a risk factor for postoperative visual outcomes.

CONCLUSION

To improve the quality of cataract surgery, the post-surgical visual outcome in a population-based study must be analyzed at regular intervals. The WHO has recommended values of ≥85% to monitor the visual outcomes of cataract surgery. The patients with good visual outcomes achieved after surgery would act as good samaritans for the community. From the observations made and results found in the present study, the following conclusions have emerged clearly:. Poor Visual outcome is more frequently seen in males, rural population group, advanced age group, middle socioeconomic status, indoor workers, and smokers. Controlled systemic diseases and eye diseases, morphological differences in the type of cataract and type of surgical technique (performed meticulously and judiciously) did not influence the post-surgical visual outcome.

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