

Year one of COVID-19 pandemic: Effect of lockdown and unlock phases on cataract surgery at a multi-tier ophthalmology network

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Purpose: To describe the impact of lockdown and unlock phases of the COVID-19 pandemic on cataract surgery at a multitier ophthalmology network. **Methods:** This cross-sectional hospital-based study included 106,279 eyes operated between March 23, 2019 and March 31, 2021. The data of patients who underwent cataract surgery presenting during the lockdown and unlock phases were compared with the respective periods in the previous year before COVID-19. **Results:** The cataract surgeries performed decreased to 5.6% (839/14,994) of pre-COVID-19 volumes during the lockdown phase. There was a gradual recovery of the cataract surgeries performed to 86.7% of pre-COVID-19 volumes by May 2020 and exceeded by 17.9% by September 2020. There was a decrease in the number of women who underwent cataract surgery during the lockdown phase (49.11%) compared to the pre-COVID-19 (52.59%) or unlock phase (52.29%, $P < 0.001$). Patients operated during the lockdown phase were younger when compared to other groups ($P < 0.001$). The mean LogMAR presenting visual acuity at the time of surgery was worse in patients operated during the lockdown phase (1.84 ± 1.16) as compared to pre-COVID-19 (1.39 ± 1.05) and unlock phases (1.51 ± 1.08 , $P = 0.001$). The proportion of patients with total cataracts were higher during the lockdown and unlock phases compared to the pre-COVID-19 phase ($P < 0.001$). **Conclusion:** The first year of the COVID-19 pandemic saw a drastic reduction in the surgical volume in the lockdown phase, which recovered quickly during the unlock period. Patients of younger age, male gender, poor presenting visual acuity, denser cataracts, and living close to the surgical center were able to access surgical care due to lockdown restrictions.

Key words: Big data, cataract surgery, COVID-19 pandemic, India

The raging COVID-19 pandemic has made visible many inequalities to the fore, including the most important aspect of access to healthcare services by populations around the world.^[1] The enforcement of the national lockdown in India in 2020 posed significant new challenges in the access to healthcare services for patients across the country.^[2] There was a disruption in regular service delivery, leading to a drastic reduction in the outpatient numbers during the lockdown phase in India. During the lockdown, the most common lens-related cause of patients seeking eye care services was related to acute painful causes, that is, traumatic cataracts and lens-induced glaucoma rather than visual debility.^[3] Cataract is the second leading cause of preventable blindness around the world. The All-India Ophthalmological Society (AIOS) during the lockdown phase had released guidelines for prospective resumption of cataract surgery, which included triage of emergency cases, use of personal protective equipment, and precautions related to clinical examination and the operating room for facilitating a safe elective cataract screening and surgery.^[4] The geriatric population is a vulnerable age group who might not be able to travel to access care due to the lockdown regulations, and

we need to promote access through the use of technology tools such as telemedicine to address all those in need during these challenging times.^[5] The COVID-19 pandemic has brought in unique challenges for ophthalmic practices, which need to adapt to the changing practice patterns and the waxing and waning of the patient populations influenced by the evolving waves of viral infections. Patients affected with cataracts have a steady progression of the pathology over years leading to a visual impairment that necessitates regular follow-up, and the progression of the cataract may warrant urgent surgical interventions for vision restoration. With this background, we describe a comparative report of the effect of lockdown and unlock of the COVID-19 pandemic on cataract surgeries performed at a multitier ophthalmology network in India.

Methods

This cross-sectional observational hospital-based study included patients presenting between March 23, 2019 and March 31, 2021 to four tertiary and 20 secondary centers of a multitier ophthalmology network located in India.^[6] A standard consent form for electronic data sharing for research purposes

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was signed by the patient or the parents or guardians of the patient at the time of registration. None of the identifiable parameters of the patient information were used for the analysis of the data. The study adhered to the Declaration of Helsinki and was approved by the institutional ethics committee. The clinical data of each patient who underwent a comprehensive ophthalmic examination was entered into a browser-based electronic medical records system (eyeSmart EMR) using a standardized template by trained ophthalmic personnel and supervised by an ophthalmologist.^[7] All patients signed a consent form acknowledging the potential risk of contracting COVID-19 infection during their visit to the hospital.

Data Retrieval and Processing: A total of 106,279 eyes of patients who underwent cataract surgery (manual small incision cataract surgery (MSICS), phacoemulsification, extracapsular cataract extraction (ECCE), and lens aspiration) at the multitier ophthalmology network during the study period were included in this study. The data of these patients were retrieved from the electronic medical record database and segregated in a single excel sheet (Microsoft Excel®). Data on patient demographics, visual acuity, lens status, and surgical intervention were used for analysis. The excel sheet with the required data was then used for analysis using the appropriate statistical software. The study duration was divided into three categories: Pre-COVID-19 (March 23, 2019–March 24, 2020), Lockdown (Phases 1–4; March 25, 2020–May 31, 2020), and Unlock (Phases 1–10; June 1, 2020–March 31, 2021).^[8] The geographic categorization was performed in relation to the location of origin of the patient to the eye care center at presentation. The patients presenting from the same location of the eye center were classified as “intracity,” those from outside the city but from the same state of the eye center were classified as “intrastate,” those from outside the state were classified as “interstate,” and those from outside India were classified as “international” patients. The demographic distribution and surgical interventions of the patients in these three categories were used for comparative analysis.

Statistical Analysis: Descriptive statistics using mean $\pm$ standard deviation and median with interquartile range (IQR) were used to elucidate the demographic and surgical intervention data using Microsoft Excel 2019 (Microsoft Corporation, Redmond, USA). Chi-square goodness of fit test and ANOVA test were used for identifying the statistical significance between the variables. Statistical significance was assessed with $P < 0.05$.

Results

Overall trend of cataract surgeries

Overall, 106,279 eyes were included in the study. The monthly average of cataract surgeries during the pre-COVID-19 phase was 4,925, which reduced to 3,931 during the COVID-19 phase (20% decline). Compared to the pre-COVID-19 phase with an average of 161 (59,105/367) surgeries per day, the number of surgeries performed during the lockdown phase was significantly lower with an average of 12 (839/68, 92.5% decline). The overall cataract procedures reached pre-COVID-19 levels in August 2020; there was a steady increase thereafter with a peak from January 2021 [Fig. 1]. The trends of the recovery were different in tertiary and secondary centers. There was an early steep increase in the number of procedures at the tertiary centers which reached pre-COVID-19 levels by June 2020. This was followed by a short decline to increase again from August

2020 and crossed pre-COVID-19 levels in September 2020. By contrast, in the secondary centers, the procedures surpassed the pre-COVID-19 numbers in August 2020 and continued to be high thereafter. There was a very steep increase in the numbers in the secondary and tertiary centers from January 2021 [Fig. 2].

Specific trends

The overall comparison between the three phases is detailed in Table 1.

Age

Patients operated during the lockdown phase were younger (Mean $\pm$ SD: 54 ± 15 years compared to pre-COVID-19 (Mean $\pm$ SD: 60 ± 13) and unlock phases (Mean $\pm$ SD: 59 ± 13 , $P < 0.001$). There was a lower percentage of patients >60 years during the lockdown phase (36.11%) compared to the pre-COVID-19 phase (55.49%), which showed an increasing trend during the unlock phase (50.32%) ($P < 0.001$).

Gender

There was a decrease in the number of women who underwent cataract surgery during the lockdown phase (49.11%) compared to the pre-COVID-19 (52.59%) or unlock phase (52.29%) ($P < 0.001$).

Place of residence

With regards to the place of origin, a proportional reduction of 10.2% and 9.5% was seen in patients requiring intrastate and interstate, respectively. There was an increase seen of 37.9% in intracity during the lockdown phase. There was a good recovery in the proportion of cataract surgeries to 112.9% for intracity, 98.9% for intrastate, and 89.1% for interstate patients during the unlock phases. The detailed comparison of the geographic presentation in all three phases is described in Fig. 3.

Service provided

The percentage of patients opting for free cataract surgery services was higher pre-COVID-19 (48%) compared to lockdown (22%) and unlock phases (29%) ($P < 0.01$). There was about a 26% decrease during the lockdown phase compared to the pre-COVID-19 phase.

Location of center

The percentage of procedures performed in the tertiary centers during the lockdown phase was higher (53.99%) compared to those in the secondary centers. By contrast, the vice versa was true in the pre-COVID-19 and unlock phases. The proportion

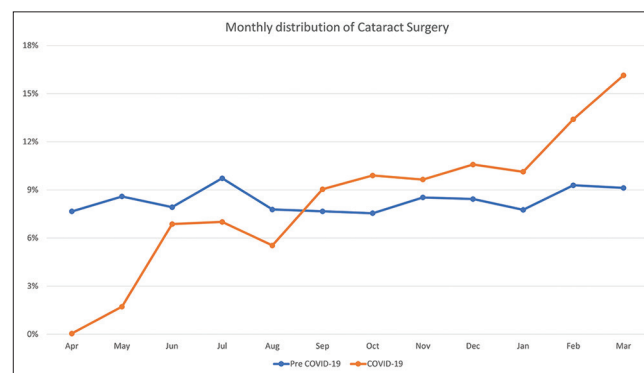


Figure 1: Overall monthly trend of patients undergoing cataract surgeries during the pre-COVID-19 and COVID-19 phases in India

Table 1: Overview of patients undergoing cataract surgery in Pre-COVID-19, Lockdown, and Unlock phases

	Pre-COVID-19, n (%)	Lockdown, n (%)	Unlock, n (%)	P
Number of Surgeries	59105 (55.61)	839 (0.79)	46335 (43.60)	<0.001
Age in Years				
20 or less	1606 (2.72)	35 (4.17)	1001 (2.16)	<0.001
21-40	2223 (3.76)	86 (10.25)	1976 (4.26)	<0.001
41-60	22474 (38.03)	415 (49.46)	20042 (43.26)	<0.001
61-80	31659 (53.57)	299 (35.64)	22605 (48.79)	<0.001
>80	1143 (1.93)	4 (0.48)	711 (1.54)	<0.001
Gender				
Male	28019 (47.41)	427 (50.89)	22106 (47.71)	<0.001
Female	31086 (52.59)	412 (49.11)	24229 (52.29)	<0.001
Place of residence in relation to surgical center				
Intracity	12516 (21.18)	245 (29.20)	11079 (23.91)	<0.001
Intrastate	35856 (60.66)	457 (54.47)	27825 (60.05)	<0.001
Interstate	10588 (17.91)	136 (16.21)	7398 (15.97)	<0.001
International	145 (0.25)	1 (0.12)	33 (0.07)	<0.001
Location of center				
Tertiary Centers	29477 (49.87)	453 (53.99)	22379 (48.30)	<0.001
Secondary Centers	29628 (50.13)	386 (46.01)	23956 (51.70)	<0.001
Grade of presenting corrected distance visual acuity				
Mild or No Visual Impairment (<20/70)	13038 (22.06)	118 (14.06)	8877 (19.16)	<0.001
Moderate Visual Impairment (<20/200)	15471 (26.18)	174 (20.74)	11502 (24.82)	<0.001
Severe Visual Impairment (<20/400)	5181 (8.77)	58 (6.91)	4250 (9.17)	<0.001
Blindness (<20/1200)	19187 (32.46)	323 (38.50)	16449 (35.50)	<0.001
Blindness (PL)	4976 (8.42)	132 (15.73)	4193 (9.05)	<0.001
Undetermined or Unspecified	1252	34	1064	
Morphology of cataract				
Mixed	30303 (51.27)	470 (56.02)	25941 (55.99)	<0.001
Nuclear	15461 (26.16)	143 (17.04)	7601 (16.40)	<0.001
Total Cataract	8860 (14.99)	153 (18.24)	8838 (19.07)	<0.001
PSC	3536 (5.98)	60 (7.15)	3015 (6.51)	<0.001
Cortical	757 (1.28)	10 (1.19)	812 (1.75)	<0.001
PPC	188 (0.32)	3 (0.36)	128 (0.28)	<0.001

n: number; PL: perception of light; PSC: posterior subcapsular cataract; PPC: posterior polar cataract

of cataract surgeries performed during the lockdown phase showed a decline at the secondary centers (46.01%) as compared to the pre-COVID-19 phase (50.13%) but improved to more than the pre-COVID-19 phase during the unlock phase (51.70%) ($P < 0.001$).

Presenting visual acuity

The mean LogMAR presenting visual acuity at the time of the surgery was worse at 1.84 ± 1.16 during the lockdown phase as compared to 1.39 ± 1.05 during the pre-COVID-19 phase and was 1.51 ± 1.08 during the unlock phase ($P = <0.001$). A higher percentage of patients with blindness category of presenting visual acuity underwent cataract surgery in all the groups. This percentage was higher in patients who underwent cataract surgery during lockdown (54.23%) followed by those during unlock phase (44.54%) compared to the pre-COVID-19 phase (40.88%) ($P < 0.001$).

Morphology of cataract

Mixed form was the most common form of cataract, followed by nuclear cataract (26.16%) in the pre-COVID-19 phase, but

total cataract was the second most common form of cataract in the lockdown (18.24%) and unlock phase (19.07%) ($P < 0.001$). There were a higher proportion of patients with total cataract in lockdown and unlock phases compared to the pre-COVID-19 phase.

Discussion

The results of our study quantify the true impact of the pandemic by measures of lockdown over the provision of cataract surgical care. Our findings suggest that the surgical numbers dropped significantly during the lockdown phase compared to the pre-COVID-19 phase and recovered by May 2020, increasing steadily to exceed the monthly average by August 2020. There was a decrease in access to care among the elderly (>60 years), women, and a greater distance from the surgical center. A higher proportion of patients having total cataracts and a worsening of visual acuity underwent cataract surgeries during the lockdown phase.

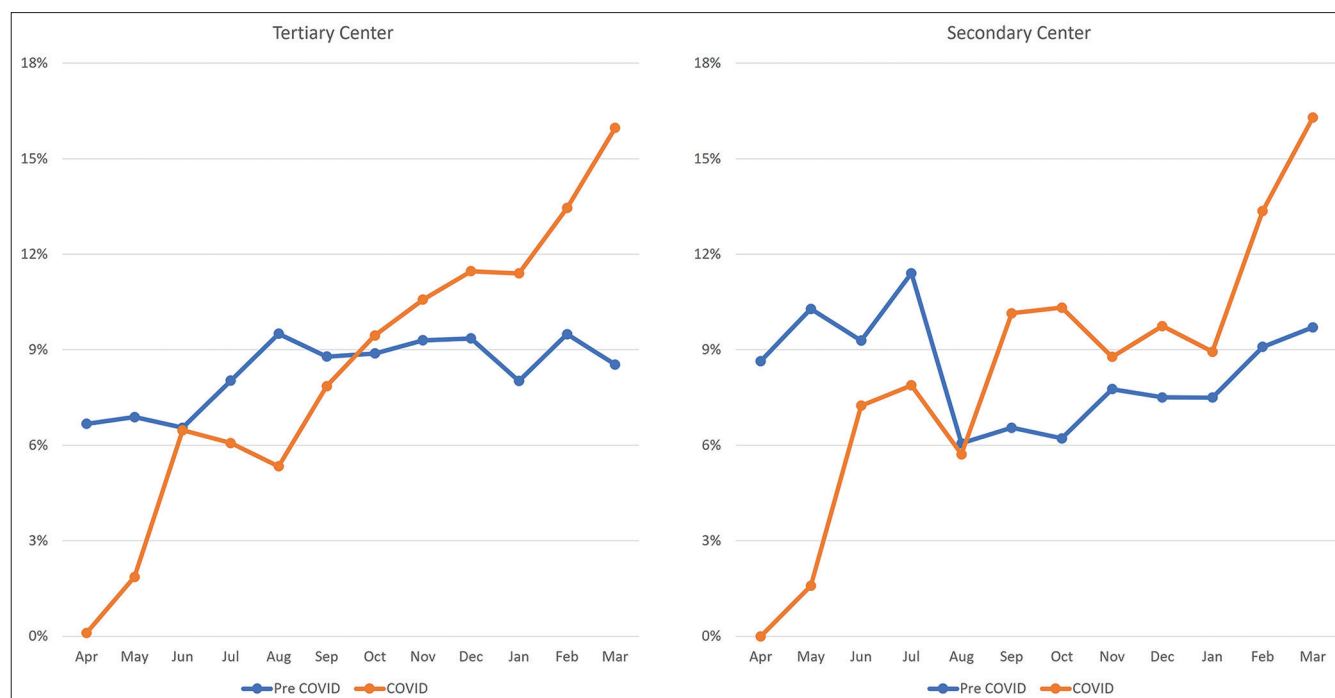


Figure 2: Overall monthly trend of patients undergoing cataract surgeries at secondary and tertiary centers during the pre-COVID-19 and COVID-19 phases in India

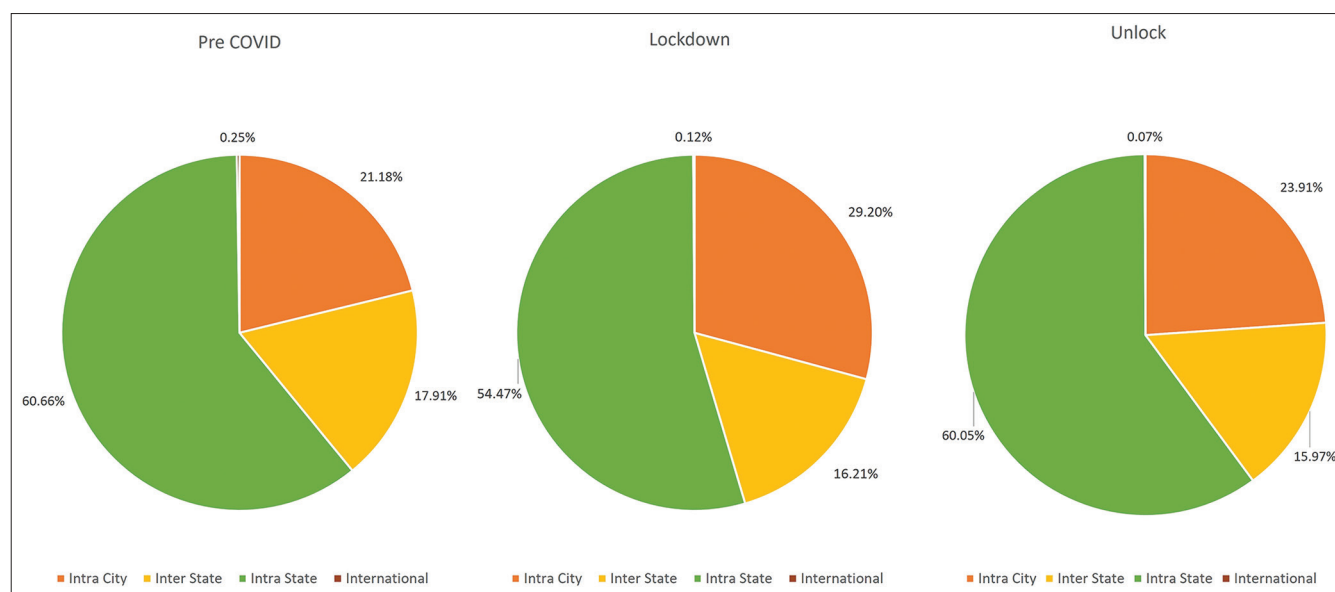


Figure 3: Geographic distribution of patients undergoing cataract surgeries during the Pre-COVID-19, Lockdown (Phases 1–4), and Unlock (Phases 1–10) in India

According to a world report on vision (2019) by WHO, globally there are at least 2.2 billion people who have vision impairment. Among these, at least half of these could have been prevented or addressed. Cataract stands second after uncorrected refractive error, accounting for approximately 65.2 million.^[9,10] Several programs have been initiated globally to address this unpreventable blindness due to cataracts with great detailed monitoring of the performance of these programs. The current pandemic has resulted in several cataract surgical centers across the globe closing or severely

decreasing the volumes, thus derailing the metrics monitored to prevent avoidable blindness. It would be difficult to find out the global impact of the current pandemic on elective cataract surgery due to variation in the severity of the pandemic and customized unlock protocols among different geographic locations.

During the first wave of the pandemic, the mortality has been very high in the elderly; this has led to a panic among health care professionals and the elderly patients needing cataract surgery to proceed with elective cataract surgery.^[11]

Delay or postponement of cataract surgery does have several ill effects in the elderly such as falls leading to fractures, poor bilateral vision, or anisometropia in unilateral cataracts or pseudophakic leading to difficulty in driving, thus increasing the susceptibility for road traffic accidents.^[12-14] These instances could lead to multiple hospital visits or admissions, thus further increasing the susceptibility to contracting COVID-19. Visual impairment due to cataract could lead to symptoms of depression and in the current pandemic, with minimal socialization possibly aggravating such symptoms in the elderly.^[15] Recently, a systematic review of 27 studies found that patients who waited >6 months for cataract surgery had less-than-expected outcomes (poor vision and poor quality of life) compared to patients who waited <6 weeks.^[16] In the current study, we did find that a greater proportion of patients <60 years accessed cataract surgical care during the lockdown phase. Understanding the consequences of delayed cataract surgery, a recent patient survey has shown that during the ongoing pandemic, with appropriate safety measures, 70%–80% of patients were willing to undergo elective cataract surgery to have an improvement in their quality of vision and quality of life. However, both patients and their family/friends were concerned about the risk of contracting COVID-19 in the process of getting the cataract surgery done.^[17,18]

The current pandemic has had a heavy impact on the psychological, social, and economic impact on eye care professionals and hospitals.^[19,20] In providing care for elective surgeries and clearing the backlog of surgeries that arouse due to lockdown, eye care facilities have been modified both structurally and functionally to provide safe service.^[4,17,18,21-27] Apart from several general modifications in the clinical and surgical setting, a few major impactful modifications have been the use of teleconsultation services and immediate sequential bilateral cataract surgery that minimizes post-operative visits.^[4,5,23] Despite all the safety protocols in place, there was a very gradual increase in the number of patients opting for care in our setting. In our network of hospitals, it took approximately 5 months from the lockdown date to surpass the pre-COVID-19 surgical numbers. This trend was slightly shorter in the secondary centers compared to tertiary centers. There was also a need to ensure confidence in patients about safety precautions followed to ensure a safe surgery. In this context, regular messages and educational videos of the protocols followed were shared from time to time.

The difficulty that the patients encountered during the lockdown phase in India were the minimal availability of public transport and the apprehension to use public transport with a fear of contracting COVID-19. We did see a greater decrease in patients opting for elective cataract surgery if they were away from the surgical center (intrastate and interstate compared to intracity). There was a big surge in the number of patients (38%) in the vicinity of the surgical center (intracity) and the trend continued even after unlock period. The recovery of post-COVID-19 numbers was higher for intracity followed by intrastate and interstate. The patients thus preferred local care compared to associated travel for getting elective cataract surgery. There was a variation in the gaining back to normalcy based on the location of the center. In the tertiary centers, the number of procedures reached to pre-COVID-19 level by June 2020, which was 2 months earlier than that seen at secondary centers (August 2020). There was a decline in

numbers in tertiary centers from June 2020 to August 2020, followed by a consistent increase in numbers, whereas in the secondary centers, the numbers remained higher compared to pre-COVID-19 levels from August 2020. In both the tertiary and secondary centers, there was a sudden steep peak from January to March 2021 as most of the activities and transport facilities have normalized across the country. There was a greater decrease in the number of surgeries performed for patients opting for free eye care during the lockdown phase. To our surprise, this trend continued even during unlock phase with a minimal improvement.

We did observe that mean LogMAR visual acuity was worse in patients who presented during lockdown; probably only those with advanced cataracts with poor visual acuity have opted for elective cataract surgery. In our series, we did see approximately 18% of patients who opted for cataract surgery had advanced cataracts, which were higher than reported earlier (12%).^[22] The increase was approximately 3.2% compared to pre-COVID-19 levels. This trend would be of great concern as the increase in the duration of lockdown in situations like the current pandemic could lead to an increase in patients with advanced cataracts. This can, in turn, lead to difficult surgery and poor visual outcomes. As per the latest (2018–2019) National Program for Control of Blindness (NPCB) data, every month there are approximately 557,568 cataract procedures done per month in India.^[28] The national shutdown of elective surgeries would have led to a significant backlog of operable cataract procedures. As noted in our series and also based on the predictive model, there could be a surge in the numbers post lockdown.^[29] There would be two phases of recovery. The first phase is to get back to the original numbers of pre-COVID-19 numbers, which may take a few months, and later, to focus on clearing the backlog of the procedures, which may take few years to achieve the same.^[29] In developing countries, where a greater number of cataract surgeries are done based on screening in camps in rural areas, the ability to achieve pre-COVID-19 targets would be a far-fetching goal. These trends should alert the policy policymakers to plan better for post-pandemic recovery and to be prepared in the future for such unplanned events.

Though the pandemic has had a considerable impact on cataract surgery rates across the globe, it did have some positive implications. First, the national and global governments realized the importance of a robust public healthcare system. Second, the current pandemic has forced patients to access care close home and hence a distributed model of eye care wherein a majority of uncomplicated procedures can be handled locally, thus minimizing the need for referral.^[6] Third, the adoption of audio and video teleconsultations by several practices has paved way for decreasing the need for travel, thus making opinions available for the needy by experts. We feel the teleconsultation service in the future could be part of regular care to minimize hospital visits.^[5] Fourth, due to the restrictive environment during the peak pandemic and during the overload after the ease of restrictions, the cataract surgery protocols have evolved. Priority-based patient-centric surgical care has been provided wherein surgical care is rationalized based on visual acuity, first or only seeing eye, etc.^[24]

The limitations of this study are that the postoperative visual outcomes, complications, and patients' and health care workers'

experience of this pandemic through questionnaires were not studied. Earlier studies have shown that visual outcomes and complications of the cataract surgery procedures during the pandemic have been comparable to those performed before the pandemic.^[23,30] Majority of patients who had the surgery have been happy with their decision of having the surgery and satisfied with safety protocols followed by the surgical center.^[30]

Conclusion

In conclusion, the authors present their experience on the impact of the COVID-19 pandemic on the cataract surgeries uptake at a multitier ophthalmology network in India. The first year of the COVID-19 pandemic saw a drastic reduction in the surgical volume in the lockdown phase, which gradually recovered during the unlock period more than the pre- COVID-19 phase. However, the impact of the ongoing second wave of the COVID-19 pandemic on this recovery remains to be seen. The policymakers and high-volume surgical centers should identify vulnerable groups, such as the elderly, women, patients, who are socioeconomically poor requiring free surgical care, and patients with advanced cataracts to reduce the inequalities in the delivery of eye care.

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Conflicts of interest

There are no conflicts of interest.

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