

Changing trend in the morphology of cataracts at a tertiary eye care centre in South India due to COVID-19-pandemic related national lockdown

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Purpose: To study the changing trends in the morphology of cataracts at a tertiary eye care center in South India due to COVID-19 pandemic-related national lockdown. **Methods:** A retrospective study conducted at a tertiary eye care center in Andhra Pradesh state of South India, which included 1724 patients (1753 eyes) who underwent cataract surgery at our center during April 2019–July 2019 (1298 eyes of 1271 patients) and April 2020–July 2020 (455 eyes of 453 patients). Factors studied included preoperative lens status, associated phacodonesis or subluxation, pupil size, other eye lens status, associated retinal problems, glaucoma, and complications during surgery. Postoperative uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), corneal clarity, intraocular pressure (IOP), and disc status at postoperative day 1, 1 week, and 1-month visits were compared. **Results:** A significantly lower proportion of nuclear sclerosis (decreased from 83.2% in last year before lockdown to 55.2% during lockdown) and significantly higher proportions of mature, brown, or black cataract and phacomorphic, phacolytic, or Morgagnian cataract (increased from 15.5% in last year before lockdown to 43.8% during lockdown) were observed. The proportion of small-incision cataract surgery decreased significantly (from 63.2% to 57.4%), whereas the proportion of phacoemulsification increased significantly (from 35.9% to 41.5%) during lockdown as compared to last year. A significantly higher proportion of eyes with small pupils and association with retinal pathology were also observed during the lockdown. **Conclusion:** During the national lockdown, there was a shift from nuclear sclerosis grade toward mature, brown, black grade of cataracts. In addition, the proportion of small-incision cataract surgery decreased significantly whereas the proportion of phacoemulsification increased significantly during the lockdown. More number of cataracts with small pupils and associated retinal pathology were observed during the lockdown.

Key words: COVID-19, morphology of cataracts, national lockdown, phacoemulsification, small-incision cataract surgery

In December 2019, an outbreak of a novel coronavirus disease (COVID-19) emerged in Wuhan, China and quickly spread throughout the world. COVID-19 is a highly contagious disease capable of progression to acute respiratory distress syndrome and even death. The infectious agent of this disease entity is a novel betacoronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).^[1] In less than 4 months, the outbreak escalated rapidly from a World Health Organization Public Health Emergency of International Concern to the formal declaration as a pandemic on March 11, 2020.^[2] COVID-19 has turned out to be the metaphoric Black Swan of the 21st century – an unexpected event of large

magnitude and consequence that has completely changed the way we live.^[3]

The Government of India imposed a countrywide total lockdown of all nonessential services in order to restrain the rapid spread of the disease. The first four phases in 2020 of this lockdown extended from March 23 to April 14, April 15 to May 3, May 4 to May 17, and May 18 to May 31.^[4] In this critical situation, the health care sector is expected to be the forerunner and safely guide the rest of the country through this global pandemic. Health care providers have the responsibility of not only providing adequate care to the patients but also protecting themselves from falling prey to this potentially deadly disease. The policy of social distancing to prevent the spread of the disease has crippled the ability of hospitals to deal with many patients.^[3] The delay in presentation to the hospital due to the lockdown and fear of infection can lead to

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progression of the disease, further intensifying the difficulties. Many eye care institutes were operational at a scale that was much less than normal due to the lockdown-related restrictions. There is a need to prevent delays in accessing hospital care and to increase provision of high-quality coordinated care by health care providers.^[5]

This is the first study in literature where we evaluated the changing trends in the morphology of cataracts at a tertiary eye care center in South India due to COVID-19 pandemic-related national lockdown.

Methods

It was a retrospective study conducted at a tertiary eye care center in Andhra Pradesh, India. Our hospital not only caters to the various districts within the state but also to the surrounding states of Telangana, Tamil Nadu, and Odisha. The study was performed after obtaining approval from the institutional ethics committee and adhered to the tenets of the Declaration of Helsinki. As a standard practice of our hospital, all subjects had previously given informed written consent for examination and for the medical records to be used for approved research purposes.

The cumulative number of patients who underwent cataract surgery at our center during April 2019–July 2019 and April 2020–July 2020 was 1724 (1753 eyes) and were included in this study. Out of these 1724 patients, 1271 patients (1298 eyes) underwent cataract surgery in 2019 and 453 patients (455 eyes) in 2020, that is, during the lockdown period. Out of these 455 eyes, 47 were operated in April, 126 in May, 145 in June, and 137 were operated in July 2021. Patients screened for COVID-19 in the triage area and those having symptoms or testing positive for COVID-19 were excluded from the study. All of these patients underwent comprehensive eye examination and necessary investigations in the follow-up visit. Data of all these patients were evaluated with the help of electronic medical record (EMR). Factors studied included preoperative lens status, associated phacodonesis or subluxation, pupil size, other eye lens status, associated retinal problems, glaucoma, and complications during surgery. Postoperative uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), corneal clarity, intraocular pressure (IOP), and disc status at postoperative day 1, 1 week, and 1-month visits were compared.

All the guidelines and precautions advised by the All India Ophthalmological Society (AIOS) were always followed by all the health care workers (HCWs). General precautions, such as maintaining a safe distance from assisting nurse, trainees, or technicians as much as possible, were followed. Proper draping and no escape of exhaled air through the gaps in the drape were ensured. Cataract surgery including phacoemulsification has not been proven to be an infective aerosol-generating procedure to date. In phacoemulsification, aqueous in the anterior chamber is replaced by viscoelastic, balanced salt solution (BSS), or ringer lactate (RL) at different points of the surgery. During the delivery of ultrasound energy, BSS or RL may get aerosolized but not the patient's aqueous humor. Thus, the risk of aerosolized virus would be very low. In manual small-incision cataract surgery, peritomy of the desired size should be made and adequate amount of cauterization may be done to work under bloodless field. The

Blumenthal technique involves the use of an excessive amount of fluid. Thus, the surgeon or the assistant should be more vigilant with the amount of fluid drained out so as to prevent spillage and ensure that all the fluid is collected in the pouch and not spilled on the floor.

The statistical analysis was performed using software STATA v14.0 (StataCorp, College Station, TX, USA). Categorical data were described as proportions and continuous data as mean \pm standard error. A linear mixed-effects model using maximum likelihood estimation with random intercepts at the level of patient was used for making comparisons between data from 2019 and 2020. $P < 0.05$ was considered statistically significant.

Results

Data from 1298 eyes of 1271 patients belonging to the year 2019 and 455 eyes of 453 patients belonging to the year 2020 were analyzed. Table 1 summarizes the patient demographics and clinical observations in the study cohorts. The proportion of patients with lower socioeconomic status significantly ($P < 0.0001$) decreased from 67% pre-COVID-19 to 50% during the lockdown. The proportions of males and rural population remained the same.

The mean age at cataract surgery significantly ($P < 0.0001$) reduced by three years during the lockdown. A significantly lower proportion of nuclear sclerosis and significantly higher proportions of mature, brown, or black cataract and phacomorphic, phacolytic, or Morgagnian cataract were observed. As per Table 1, although the percentage of mature/brown cataracts is more in the group operated in 2020, but in numerical terms, the number is almost the same (April 2020: 28 eyes; May 2020: 55 eyes; June 2020: 76 eyes; July 2020: 45 eyes); the high percentage is a result of lower total subjects in this group. A significantly higher proportion of eyes with small pupils and association with retinal pathology were also observed [Fig. 1]. Patients who were one-eyed were proportionately higher during the lockdown, whereas those who were diabetics and who already underwent cataract surgery with implantation of intraocular lens in the other eye were proportionately lower.

The proportion of small-incision cataract surgery decreased significantly whereas the proportion of phacoemulsification increased significantly during the lockdown [Fig. 1]. The visual

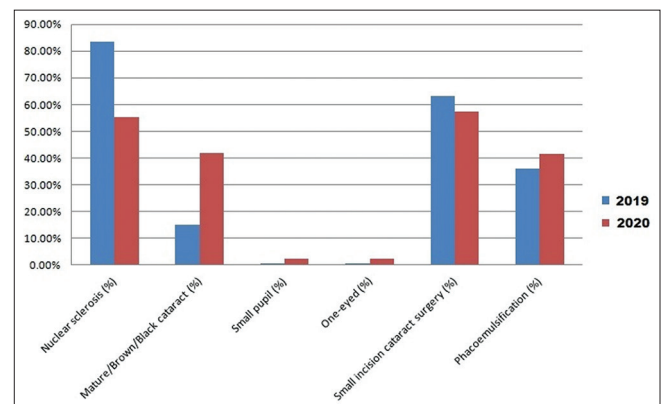


Figure 1: Changing trends during national lockdown

Table 1: The patient demographics and clinical observations in the study cohorts

Variable	Year 2019 1271 patients 1298 eyes	Year 2020 453 patients 455 eyes	P
Nonpaying: Paying (% Nonpaying)	847:424 (66.6%)	225:228 (49.7%)	<0.0001
Male: Female (% Male)	623:648 (49.0%)	242:211 (53.4%)	0.12
Rural: Urban (% Rural)	116:1155 (9.1%)	35:418 (7.7%)	0.42
Age at surgery (years), mean±SE	59.6±0.3	56.3±0.6	<0.0001
Nuclear sclerosis (%)	1081 (83.4%)	251 (55.2%)	<0.0001
Mature/Brown/Black cataract (%)	194 (15.0%)	191 (42.0%)	<0.0001
Phacomorphic/phacolytic/Morgagnian cataract (%)	7 (0.5%)	8 (1.8%)	0.02
Traumatic cataract (%)	11 (0.9%)	5 (1.1%)	0.63
Phacodonesis (%)	12 (0.9%)	3 (0.7%)	0.60
Subluxation (%)	8 (0.6%)	3 (0.7%)	0.92
Small pupil (%)	8 (0.6%)	10 (2.2%)	0.004
One-eyed (%)	8 (0.6%)	11 (2.4%)	0.004
Other eye clear (%)	31 (2.4%)	18 (4.0%)	0.11
Other eye pseudophakia (%)	452 (34.8%)	123 (27.0%)	0.002
Other eye aphakia (%)	9 (0.7%)	2 (0.4%)	0.56
Other eye cataract (%)	798 (61.5%)	301 (66.2%)	0.08
Associated with glaucoma (%)	39 (3.0%)	13 (2.9%)	0.87
Disc changes (%)	31/1107 (2.8%)	8/252 (3.2%)	0.75
Associated with retinal pathology (%)	42 (3.2%)	43 (9.5%)	<0.0001
Diabetes mellitus (%)	338 (26.1%)	78 (17.1%)	0.0002
Small incision cataract surgery (%)	820 (63.2%)	261 (57.4%)	0.03
Phacoemulsification (%)	466 (35.9%)	189 (41.5%)	0.03
NPL/PL/PR (%), Day 1	10 (0.8%)	2 (0.4%)	0.46
NPL/PL/PR (%), Day 7	5 (0.4%)	1 (0.2%)	0.60
NPL/PL/PR (%), Day 30	2 (0.2%)	1 (0.2%)	0.77
BCVA Day 1 (logMAR), mean±SE	0.54±0.02	0.58±0.03	0.30
BCVA Day 7 (logMAR), mean±SE	0.38±0.01	0.41±0.02	0.16
BCVA Day 30 (logMAR), mean±SE	0.18±0.01	0.19±0.02	0.73
Intraocular pressure >21 mm Hg (%), Day 1	109 (8.4%)	16 (3.5%)	0.0007
Intraocular pressure >21 mm Hg (%), Day 7	17 (1.3%)	5 (1.1%)	0.92
Intraocular pressure >21 mm Hg (%), Day 30	8 (0.6%)	3 (0.7%)	0.92

outcomes were comparable between the years at postoperative follow-up visits on days 1, 7, and 30. The proportion of eyes with increased intraocular pressures (>21 mm Hg) were also comparable except on postoperative day 1 where it was significantly lower during the lockdown.

Discussion

The novel coronavirus (SARS-CoV-2) appeared in the Chinese city of Wuhan and precipitously extended across the globe.^[6] The lockdown measures to curb the growth of the COVID-19 pandemic brought the country to a standstill as all public transport services were stopped and free movement of the public for nonessential work was restricted. The reduced OPD and surgical volume not only posed a major financial challenge to the institute but also increased the chances of high-risk patients not receiving adequate treatment.^[4]

The literature has no reports of the effect of COVID-19 pandemic-related national lockdown on the changing trends in the morphology of cataracts. This is the first study reporting

the impact of COVID-19 related national lockdown on the changing trends in the morphology of cataracts at our center.

The All India Ophthalmological Society (AIOS) provided guidelines to assist the ophthalmology fraternity regarding the optimum strategies to cater to patients without increasing the chances of exposure for both the patients and health care workers (HCWs).^[4] Specific measures taken at the point of entry, waiting room, out-patient clinic, procedure room, and operation theatre, such as mandatory 2-m physical distancing and wearing personal protective equipment, face shield, face mask, hair cover, and hand hygiene, constitute the new normal in our ophthalmology practice.^[7-11]

The mean age group of our patients, 56.3 years, is similar to that in other Asian countries such as Singapore or Taiwan, where the mean age was more than 55 years.^[12,13] The male preponderance in our patient group is similar to that in other studies in India, Singapore, and Iran.^[12,14-16] This may be due to the higher probability of females remaining at home involved with their children due to the shutdown of schools.^[4]

There could also be gender bias in accessing health care in a male-dominant society like ours.^[17]

On March 22, 2020, the Government of India suspended air, train, and bus modes of travel across the nation, bringing to halt flights, trains (the Indian Railways runs 13,500 passenger trains a day), and all local transport bus services till March 31, 2020.^[18] When travel restrictions were imposed as the lockdown progressed, the distance to travel to the hospital became a limiting factor. The lockdown curtailed the provision of care, further compounding the problem of patient access to care.^[18] These factors had an impact on patient footfall as patients were unable to reach the eye hospital for follow-up visits. Very few (7.5%) patients in our study were from rural areas as it was difficult to travel from rural areas to our hospital during the lockdown.

At our institute, the economic status of every patient is assessed to determine the patient's ability to pay for the services. For patients who are unable to pay, all our eye care services are provided at no cost.^[16] The lockdown in India had a severe impact on the labor-class people. Approximately 400 million labor-class people plunged deeper into poverty due to the lockdown.^[19] Most of these labor-class people belonged to the unorganized work sector. In addition, the other most affected people belonged to the migratory labor class, which is mostly rural in origin. The catastrophic economic effect the lockdown had on these people put health care priority on an extremely low order as they fought for their minimum needs. This can be the reason for the low ratio of the nonpaying patients seeking cataract surgery services during and post lockdown (49.7% patients) as compared to the pre-lockdown phase (66.6% patients). The percentages of eyes with small pupils reported in the present study during lockdown (2.2%) compare well with the previously reported percentage of 1.6% by Gimbel^[20] although the patient population was different. There was a statistically significant increase in the percentage of eyes with small pupils during lockdown (2.2%) as compared to eyes with small pupils before lockdown (0.6%) during the same duration of previous year.

Cataract surgery is an elective surgery most of the time. During the lockdown, people were facing the following barriers for accessing health care: Imposition of lockdown inducing a sense of fear in the public, preventing them from visiting hospitals for ophthalmic needs; most of the ophthalmic institutes running only emergency services and thus avoiding elective cataract surgeries; and economic constraints leading to the postponement of cataract surgery for many patients. Apart from the abovementioned direct effects, there were many indirect consequences of the lockdown and COVID-19 disease that led to an increase in the incidence of total cataracts in the population. Rampant usage of systemic steroids for the treatment of COVID-19 may have led to the rapid progression of cataracts, especially in diabetic patients.^[21] Being under lockdown, most people were forced to lead a sedentary lifestyle. This may in turn have hampered the blood sugar levels in diabetic patients, further aggravating the causation and progression of cataracts.^[22,23] The statistically significant increase in the number of patients presenting with higher grade of cataracts, including total/brunescant/black/Morgagnian cataracts ($P < 0.0001$), phacomorphic/phacolytic glaucomas ($P < 0.0001$), one-eyed patients with

cataracts ($P = 0.004$) in the lockdown and post-lockdown phase can be attributed to the factors highlighted above.

There are concerns among ophthalmologists regarding whether the rapid oscillations of the phacoemulsification probe could generate aerosols, but it was found that removal of aqueous humor with irrigation and aspiration or by displacement with viscoelastic at the beginning of the case are both sufficient to remove potential viral particles from the anterior chamber without the production of aerosols. Longitudinal and torsional phacoemulsification with a 2.2-mm tip does not generate significant aerosolization.^[21] After knowing these facts and despite the high proportion of total cataracts during the lockdown in our study, the proportion of phacoemulsification increased significantly whereas the proportion of small-incision cataract surgery decreased significantly during the lockdown.

India has the second-highest number of diabetics in the world, second only to China.^[22] Ghosal *et al.*^[23] created a simulation model to predict the effect of lockdown on diabetes control and its complications. They predicted an annual percentage increase in complication rates at the end of 30-day lockdown as 2.8% for nonproliferative diabetic retinopathy, 2.9% for proliferative diabetic retinopathy, and 1.5% for retinal photocoagulation. In our study, there was a statistically significant increase in the retinal pathologies detected in patients during and post lockdown, the most common of which was diabetic retinopathy. Interestingly, as per Table 1, the percentage of diabetics in patients operated in 2020 is less compared to those operated in 2019, which is in conflict with the hypothesis blaming diabetes as the main cause of mature cataracts.

This study demonstrates that removing barriers to care, whether economic, social, or otherwise, can bring the health care system closer to the patient, potentially improving visual outcomes.^[24] For example, our hospital has established a permanent infrastructure for base hospitals or secondary centers and vision centers in the communities of South India. These centers, respectively led by one trained ophthalmologist and one vision technician, provide basic vision care in small rural communities with the help of teleophthalmology. In these unprecedented times of adapting to large-scale changes, where we are challenged to formulate newer mechanisms of service delivery to our patients, we need to intuitively base our decisions and strategies focusing on fluid data.^[16] This will enable the provision of excellent, equitable, and efficient eye care services to all our cataract patients in any future crisis.

The limitations of the study include all aspects of a retrospective study. One of the main limitations of this study is the nonavailability of cataract-related data for comparison in a situation like a lockdown in the past as this is the first time in history when the country declared a nationwide lockdown.

Conclusion

A significantly lower proportion of nuclear sclerosis (decreased from 83.2% in last year before lockdown to 55.2% during the lockdown) and significantly higher proportions of mature, brown, or black cataract and phacomorphic, phacolytic, or Morgagnian cataract (increased from 15.5% in last year before lockdown to 43.8% during the lockdown) were observed.

The proportion of small-incision cataract surgery decreased significantly (from 63.2% to 57.4%) whereas the proportion of phacoemulsification increased significantly (from 35.9% to 41.5%) during the lockdown as compared to the year before that. The proportion of patients with lower socioeconomic status significantly ($P < 0.0001$) decreased from 67% pre-COVID-19 to 50% during the lockdown. A significantly higher proportion of eyes with small pupils and association with retinal pathology were also observed.

Every crisis brings about a unique opportunity to rethink the path undertaken for the development of human beings, communities, and society. Hopefully, the lessons learned from this pandemic in managing and planning medical logistics will help the world better prepare for the unexpected, long before the outbreak of the next infectious disease.

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Conflicts of interest

There are no conflicts of interest.

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