Original Article

Managing vitreoretinal surgeries during COVID-19 lockdown in India: Experiences and future implications

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Purpose: The study aims to describe the clinical and demographic profile of patients who required vitreoretinal surgeries during the novel coronavirus disease-2019 (COVID-19) lockdown in India. It also reports our operating protocols and initial experience while performing vitreoretinal surgeries during COVID-19 times at a government tertiary eye care hospital. **Methods:** This is a retrospective cross-sectional observational study of patients requiring emergent/urgent vitreoretinal surgeries between March 25, 2020 and May 31, 2020. A modified working protocol focussing on the enforcement of standard COVID-19 precautions, OT sterilization, and formation of dedicated infection control and disease surveillance committee was adopted. Patients underwent standard vitreoretinal procedures under general/local anesthesia. Relevant demographic and clinical data were recorded and analyzed. Surveillance data of healthcare workers (HCW) was also analyzed. **Results:** Eighty six patients were considered for vitreoretinal surgery in this period. Finally, 83 patients underwent surgery. The mean age of the patients was 38.4 ± 20.1 years (Range, 1 month - 75 years). Majority of them were males (66%) and adults (82.6%). Majority of them came from nearby hotspot areas. Most common indications were acute retinal detachment (38.5%) and diabetic vitrectomies (22.9%). Trauma-related cases (14.4%) were less. Surgery was deferred in 3 patients who turned out to be COVID-19 positive. 4 HCWs were quarantined but none of them developed COVID-19 disease. **Conclusion:** During COVID-19 lockdown, vitreoretinal surgeries were most commonly performed for retinal detachment and diabetic complications. Proper implementation of infection control protocols helps in delivering adequate patient care while ensuring the safety of caregivers during this pandemic.

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The first case of novel coronavirus disease 2019 (COVID-19) in India was confirmed by the Government of India on January 30, 2020. To contain the spread of COVID-19, a nationwide lockdown was implemented in five phases (Phase 1: March 25–April 14, 2020, Phase 2: April 15–May 3, Phase 3: May 4–May 17, Phase 4: May 18–May 31, Phase 5: June 1–June 30, 2020).[1] Ophthalmologists have been severely impacted due to COVID-19 lockdown.[2] To manage the impact of COVID-19, various guidelines have been issued by national and international ophthalmology organizations to effectively treat patients. These focus on triaging, infection control, personal protective equipment (PPE), and social distancing.[3-5]

In the initial lockdown days, only emergency health services were allowed. Routine OPD/health care services were discouraged. Nair at al reported that only 27.5% of ophthalmologists were able to attend emergency services creating an enormous crisis for patients requiring urgent intervention.[2] Our center was able to continue functioning albeit in a restricted manner during this crucial period.

The pattern of patients visiting ophthalmology hospitals also changed during the lockdown. Das *et al*. has reported that vitreoretinal emergencies were the major ophthalmic pathology that were attended and which required any surgical intervention.[6] At our center, vitreoretinal surgeries were the second most commonly performed surgery after ocular trauma surgeries during lockdown. Dealing with vitreoretinal emergencies pose high risk of COVID-19 exposure to healthcare workers (HCW) as it involves close proximity with patients, long contact time, and long duration of surgeries. Thus, this study was undertaken to report the initial experiences of managing vitreoretinal surgeries during COVID-19 times while the nation faced an unprecedented lockdown forcing various healthcare facilities to suspend their operations temporarily. The study also aims to describe the clinical and demographic profile of patients who required vitreoretinal surgeries.

Methods

This retrospective cross-sectional observational study was conducted at a government tertiary eye care hospital. We included patients who required vitreoretinal surgery during the COVID-19 lockdown from March 25, 2020 to May 31,

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2020 (till Phase 4). From phase 5, additional relaxations were given by the state authorities allowing resumption of routine services to some extent, which were minimally available during previous phases. The study adhered to the tenets of the Declaration of Helsinki and conformed to the local institutional ethics committee guidelines. Appropriate written informed consents were obtained from the patients undergoing vitreoretinal surgery. Consecutive patients were recruited to avoid any selection bias. Only those patients who required emergent care or urgent care (those patients whose condition worsened during follow-up requiring immediate surgical intervention/monocular patients) were included in the study. This stratification was based on guidelines issued by All India Ophthalmic Society (AIOS) and American Society of Retina Specialists (ASRS).[3,7] These cases underwent standard vitreoretinal procedure under either local anesthesia (LA) or general anesthesia (GA) depending on the age, disease profile, systemic stability of the patient and discretion of the clinician.

The demographic data and clinical details of the patients who presented to ophthalmic emergency department requiring surgical intervention for vitreoretinal indications during the study period were recorded. The patients were then evaluated by vitreoretinal unit of our hospital. Patient triaging was done before examining the patient and then again at the time of planning surgical intervention. A detailed history regarding the patient's demographic details including residential address (to rule out COVID-19 susceptibility due to hotspot area), recent travel, systemic symptoms like sore throat, dry cough and fever and other systemic comorbidities like hypertension, diabetes mellitus, cardiac history, chronic obstructive pulmonary disease, etc. was elicited. A positive history suggestive of COVID-19 at any point mandated a visit to the flu clinic where further evaluation could be done and the requirement of a COVID-19 real-time reverse transcription polymerase chain reaction (RT-PCR) test would be assessed. As per hospital policy, these patients were subjected to RT-PCR to rule out COVID-19 before taking the patient for emergency vitreoretinal surgery. Hotspot areas are defined as areas of cities in which six or more people have been tested positive for COVID-19.[8] Data about these areas was recorded based on regular updates provided by the Ministry of Health and Family Welfare, Government of India and state authorities. We implemented the following protocol based on inputs from various COVID-19 related guidelines.[3,7,9]

Cautions taken at the first point of contact (Emergency department)

Patients filled a questionnaire requiring details of travel and symptoms. A positive history warranted referral to flu clinic for further evaluation. Patients were instructed regarding use of proper mask, cough etiquette, social distancing, and hand sanitization at every point of contact. All HCWs in the hospital used N95 masks, face-shield or safety goggles, disposable gown, and gloves while providing patient care [Fig. 1a]. Equipment such as slit lamps had breath shields attached. Contact procedures and use of direct ophthalmoscope were discouraged.

Role of dedicated Infection control and COVID-19 surveillance team in hospital

In case if any patient tested COVID-19 positive, a preset protocol was followed to shift the patient to the designated COVID-19 care facility along with isolation of the patient and terminal cleaning of the area where the patient was lodged. Contact tracing was also initiated by the hospital infectious control committee (HICC). The HICC is headed by an experienced microbiologist along with members consisting of representatives of the nursing staff, sanitation staff, and residents. After detailed contact tracing, all contacts were classified into high-risk or low-risk depending on their exposure, use of PPE and comorbidities. As per hospital policy, high-risk contacts were defined as anyone in close proximity (within 1 meter) of the confirmed case without mask (both case and contact) for a duration of more than 15 min or involved in aerosol-generating procedure/contact with respiratory secretions without wearing PPE. High-risk contacts were quarantined and advised a COVID-19 RT-PCR test on day 7 following contact. Low-risk contacts continued working with attention to development of any symptoms.

Cautions taken after admitting the patient

As per our hospital policy, vitreoretinal surgery is not performed as a day-care procedure. Thus, patients were admitted a day prior to surgery and were kept in separate cubicles. Only one attendant was allowed. Temperature chart for each patient was maintained.

Modification of operation theatre (OT) functioning and sterilization protocol

The OT functioned with minimal staff in different teams/shifts. Some modifications were also made in the OT sterilization protocol. After cleaning floors and walls with detergent, Ecoshield solution (11% hydrogen peroxide) was additionally applied to mop them. 1% hypochlorite can also be used as an alternative for cleaning of floors and walls. OT surfaces were sprayed and cleaned with Bacillocid Rasant (rapid disinfectant containing glutaraldehyde) in between two cases. Routine use of 1% hypochlorite or 70% isopropyl alcohol-based disinfectant was done in-between cases. At the end of the day, fogging was done by using Ecoshield or Bacillocid special disinfectant. To maintain strict asepsis, Ultraviolet (UV) light was also switched on overnight.

Cautions taken while performing surgery in the operation theatre

Minimum number of personnel was ensured. Use of face-shield over N95 masks was encouraged. Some cases underwent vitreoretinal surgery using "heads-up" 3D visualization system (Ngenuity, Alcon Inc.). Using "heads-up" 3D visualization system increased the distance between the surgeon and the patient further minimizing the risk of exposure [Fig. 1b]. Use of passive polaroid glasses provided an additional barrier for the surgeon. Talking by the surgeon, staff, and patients were discouraged. Before initiation of surgery, use of povidone-iodine was ensured. Gentle manipulation of tissues was encouraged avoiding spillage of body fluids. During vitrectomy, valved cannulas were preferred and judicious use of diathermy was done.[5]

All patients were examined and discharged the next day. Follow-up visits were minimized.

Results

In the present study, we evaluated 86 patients in the emergency department who required vitreoretinal surgery. Finally, 83 of these patients underwent surgery. The baseline characteristics of the patients who were evaluated for surgery are illustrated in Table 1. These are significantly lower than the usual number

of patients that we catered in the pre-lockdown period (>50 patients/day).

Age

The mean age of the patients was 38.4 ± 20.1 years (range, 1 month - 75 years) (median age, 41.5 years). Majority of them were adult patients. Only 17.4% (15) of them were children (less than 18 years of age) [Tables 1 and 2].

Gender

Around 2/3 of patients who required surgical evaluation were male. In the pediatric age group, 13 out of 15 patients were male [Tables 1 and 2].

Systemic comorbidities

Hypertension and diabetes were the most common associated systemic diseases. Interestingly, 45% of the patients had associated systemic co-morbidities. This finding assumes significance in patients undergoing retinal surgeries as these patients are more prone to develop serious COVID-19-related complications.

Area of residence

Due to enforcement of strict lockdown, majority of the patients came from Delhi, Haryana and nearby areas of Uttar Pradesh. Patient footfall from Eastern India reduced drastically. These patients contributed to a significant portion of our patient load during the pre-COVID-19 time [Table 1].

Due to local epidemiological increase in the number of COVID-19 cases, majority of the patients who attended our emergency came from hotspot areas and required extra vigilance during workup [Table 2].

Table 1: Baseline characteristics of patients who were evaluated for vitreoretinal surgery

Parameter	Baseline characteristics (*n*=86)
Age (Mean±SD*, Range)	38.4±20.1 years (1 month- 75 years)
Gender (%)	
Male	57 (66.3%)
Female	29 (33.7%)
Systemic Comorbidities (%)	39 (45.3%)
Diabetes	25 (29.1%)
Hypertension	26 (30.2%)
Cardiovascular disease	4 (4.6%)
Obesity	2 (2.3%)
Cerebrovascular disease	3 (3.5%)
Chronic Kidney Disease	3 (3.5%)
Asthma	4 (4.6%)
Prematurity related co-morbidities	3 (3.5%)
High-risk history on initial triaging (symptoms, contact with COVID-19 positive patients) (%)	16 (18.6%)
States in which patients were residing (%)	
Delhi	46
Haryana	13
UP	20
Rajasthan	3
MP	1
Assam	1
Bihar	1
Jharkhand	1

*SD - Standard deviation

Result of Patient triaging and COVID-19 testing

Around 19% of patients were categorized as high-risk on initial triaging based on symptoms, travel history, and contact with COVID-19 positive patients. All of them came from hotspot areas. Based on the availability of COVID-19 testing facility and our hospital policy, we were able to get COVID-19 RT-PCR done in 52 patients (residents of hotspot areas or other suspicious cases based on risk assessment) before they were taken for surgery. 3 patients tested COVID-19 positive on RT-PCR. These three patients suffered from acute retinal detachment (RD) and came from hotspot areas. One of these patients also had heart disease. Two of these three patients did not show any symptoms of COVID-19. Surgery was deferred in these cases until the resolution of COVID-19. During our study period, we did not have a dedicated ophthalmology operation theatre available for the treatment of COVID-19 positive patients. All these patients were managed in dedicated COVID-19 wards of the attached general hospital. After discharge from the COVID-19 treating facility, two of the three patients were lost to follow-up. One underwent vitreoretinal surgery after recovery (but this was done beyond the study period of this paper).

Characteristics of patients undergoing vitreoretinal surgery

83 out of 86 evaluated patients underwent vitreoretinal surgery during the study period. This number is significantly lower than the average number of vitreoretinal surgeries performed prior to the lockdown (466 vitreoretinal surgeries/month). The details are described in Table 2. Patient stratification was done based on the risk of vision loss, severity of disease, visual potential and systemic stability. Surgery for disorders like retinal detachment (>4 weeks duration) or vitreous hemorrhage/ tractional retinal detachment (TRD) was only undertaken for mono-ocular patients or if the pathology seemed to be worsening and risk of permanent visual loss was imminent. 68 cases underwent surgery under LA and 15 cases under GA. The most common surgical indication was acute retinal detachment (38.5%) followed by diabetic vitreous hemorrhage with co-existent TRD (20.5%) and retinal detachments (>4 weeks old) (20.5%). In pre-COVID-19 times also, retinal detachment surgeries constituted majority of our surgical load (38%). In the present study, 10 cases of endophthalmitis and 2 cases of retinal detachment (12 out of 83, 14.4%) were related to trauma. The trauma-related vitreoretinal surgery volume was much less as compared to pre-COVID-19 times (32%). 25% of the current trauma-related cases were due to industrial accidents, 8% due to road traffic accidents and rest 67% due to trauma at home. Trauma at home saw a sharp 60% increase during the lockdown (especially in children). Before lockdown, the number of trauma cases caused due to road traffic accidents was similar to that of domestic accidents. 3 babies required immediate surgical intervention due to various complications related to stage 4A retinopathy of prematurity (ROP). These babies required specialized anesthetic care during GA and postoperative neonatal support was provided by the dedicated pediatric high dependency unit at our center. Their numbers have also reduced (>80%) as compared to pre-COVID-19 times. This could be possibly due to difficulty in availing transport and poor access to healthcare facility. 2 cases (2.4%) underwent

Table 2: Characteristics of patients who finally underwent vitreoretinal surgery

Indication of vitreoretinal surgery	Anesthesia required (GA/LA)	No. of patients operated (*n*=83)	No. of patients requiring re-surgery	Mean age of patients±SD* (years)	No. of males	No. of patients having Systemic co-morbidities	No. of patient who came from Hotspot areas	Fellow eye treatment needed
Acute Retinal Detachment	LA	25 (30.1%)	3	41.9±17.2	16	9	18	7
	GA	7 (8.4%)	0	12±3.4	6	1	5	4
ROP surgery	GA	3 (3.6%)	0	0.1±0.05	3	3	2	3
Retinal detachment (>4 weeks)	LA	16 (19.3%)	0	37.7±14.8	11	4	10	3
	GA	1 (1.2%)	0	11	1	0	0	0
Acute endophthalmitis (Trauma-related)	LA	6 (7.2%)	0	63.7±7.8	1	2	5	0
	GA	4 (4.8)	0	10.5±1.7	3	0	0	0
Diabetic vitreous hemorrhage with posterior pole TRD/TRD involving macula	LA	17 (20.5%)	1	49.1±8.8	11	17	13	5
Diabetic dense vitreous hemorrhage	LA	2 (2.4%)	0	66.5±10.6	2	2	0	2
Silicone oil removal (high IOP, severe emulsification)	LA	2 (2.4%)	0	35±11.3	1	0	0	0

*SD: Standard deviation

silicon oil removal surgery as an emergency procedure as they developed medically uncontrolled intraocular pressure (IOP) and severe emulsification. Many patients of our study were concurrently treated with LASER in the fellow eye also, due to presence of lesions which predispose to RD or for indications related to worsening diabetic retinopathy (DR).

Overall, majority of the patients underwent a single surgery with less than 5% of cases requiring resurgery.

Number of Healthcare workers affected by COVID-19

Only 4 HCWs were considered as high-risk contacts as per the criteria described above. They were quarantined. None of them developed COVID-19 disease.

Discussion

The COVID-19 pandemic has severely jolted the ophthalmology specialty. This has led to the formulation of guidelines and innovative ideas by various individuals and organizations for helping clinicians, surgeons, trainees, and other HCWs who have been significantly affected by the pandemic.[3,5,7,9-13]

The present study noted that majority of the patients who accessed emergency eye care were from local areas. Access to healthcare facilities had become difficult during the lockdown. This has probably resulted in the underrepresentation of children (particularly the girl child) in our study. This inequitable distribution has also been highlighted by Das *et al*. who studied the profile of patients attending eye emergency during lockdown in Hyderabad.[6] As the COVID-19 cases increased rampantly in our region, majority of the patients came from hotspot areas. Most of the patients who required surgery had systemic comorbidities like diabetes mellitus, hypertension, obesity, chronic kidney disease, respiratory problems, etc. making them 'high risk' group for contracting and transmitting COVID-19. These also predispose them to develop serious complications associated with COVID-19.[14]

There is limited literature regarding the epidemiology of vitreoretinal emergencies during the lockdown.[6] Though the number of surgeries performed drastically dropped in this period, RD surgeries remained the most common surgeries that were performed. Prognosis of RD depends on the extent and duration of disease. Delay can cause irreversible retinal changes and permanent photoreceptor atrophy. Thus, intervention was also done for operable cases of old RD (>4 weeks) in selected patients. Diabetic vitrectomies for vitreous hemorrhage and TRDs were performed in one-eyed patients and in those cases, who showed worsening with time. The study also highlights the need to evaluate and treat fellow eye pathology. Das *et al*. has also found that vitreoretinal emergencies were the most common causes requiring surgical intervention during lockdown.[6] These study findings should be considered by authorities for appropriate resource allocation and preparedness for the future.

The study has highlighted the indispensable role of infection control and COVID-19 surveillance team/HICC in ensuring better implementation of infection control practices and disease surveillance in the hospital.[15] The active surveillance of active COVID-19 patients, contact tracing and risk assessment of the contacts probably enhances safety of other HCW. Such teams can ensure implementation of protocols of terminal disinfection of wards along with isolation and proper management of COVID-19 positive patients. They also coordinate with other hospital departments/health authorities and ensure a safe and sterile working environment in hospital at all the times.

There is a level of uncertainty among ophthalmologists regarding efficacy of strategies to combat COVID-19 which can help in ensuring the safety of HCWs and delivery of adequate patient care. The present study reinforces the utility of standard COVID-19 precautions for healthcare delivery during the COVID-19 crisis. We believe that the basic principles and protocols followed in our study can be applied to other ophthalmic subspecialties as well.

The present study shows the possibility of asymptomatic/mildly symptomatic patients coming from hotspot areas to be COVID-19 positive. These patients often act as a possible source of spreading infection to HCWs and other patients in the hospital. To counter this threat, strict implementation of COVID-19 related protocols and precautions should be followed at all times. Exposure to COVID-19 patients without following due precautions can result in labeling HCWs as high-risk contacts who would have a greater risk of acquiring disease. They would also then have to be subjected to quarantine. This could have a

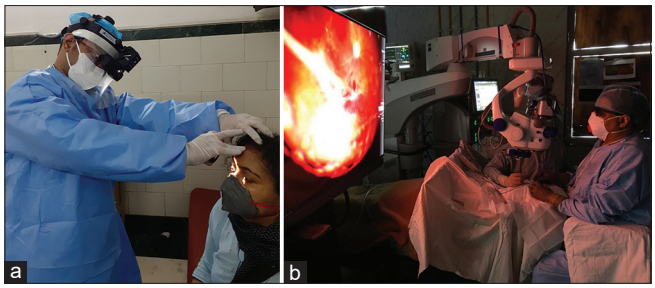

Figure 1: (a) Ophthalmologist doing retinal examination wearing PPE including face-shield (customized slots for accommodating eyepieces of indirect ophthalmoscope). (b) Retinal surgeon doing vitrectomy using ''heads-up'' 3D visualization system, wearing PPE and taking standard COVID-19 precautions

negative impact on the mental, physical, and psychosocial health of HCW. This also leads to loss of valuable human resources required for the adequate functioning of healthcare facilities.

None of the HCWs contracted COVID-19 disease while delivering patient care in our study. Only few of them required quarantine. This was possible due to increased awareness and enforcement of standard precautions among HCWs. Equal credit goes to the hospital administration for ensuring adequate supply of PPE, sanitizers, disinfectants, and other resources needed for preventing COVID-19 infection.

One of the limitations of this study is that we might have missed some of the COVID-19 positive patients who were either asymptomatic or came from non-hotspot areas as all the patients requiring vitreoretinal surgery did not undergo COVID-19 testing (RT PCR/antibody-based) prior to surgery. The government guidelines during the study duration did not mandate COVID-19 testing of all patients prior to surgery. The present study can have biases related to the particular catchment area of the hospital, health-seeking behavior, economic profile of patients visiting the hospital and local epidemiological trend of COVID-19 transmission.

With the rising number of COVID-19 cases in India, the number of patients and HCWs contracting COVID-19 will increase. This will surpass the numbers described in the present study. However, the basic principles of this study like patient stratification, triaging, strict implementation of precautions, infection control protocols, and dedicated infection control surveillance will assume more significance to minimize the risk of HCW contracting COVID-19.

Conclusion

In conclusion, the authors present their experience in managing vitreoretinal surgeries during the nationwide COVID-19 lockdown. The protocols described and the study results can aid policy planners and other health caregivers in formulating future guidelines, better resource allocation, and adopting preparedness measures to ensure safe ophthalmic healthcare delivery in the present COVID-19 crisis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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