

# Preoperative COVID-19 testing for elective vitreoretinal surgeries: Experience from a major tertiary care institute in South India

Naresh Babu Kannan, Sagnik Sen, Harshavardhan Reddy, Karthik Kumar, Renu P Rajan, Kim Ramasamy

**Purpose:** To study the prevalence of asymptomatic SARS-CoV-2 virus infection (COVID-19) among patients undergoing elective vitreoretinal surgeries at a tertiary care eye hospital. **Methods:** This cross-sectional, observational study was performed between July 16, 2020 and August 31, 2020, in the retina clinic of a tertiary care eye hospital in south India. All patients undergoing elective retinal surgical procedures underwent RT-PCR testing for SARS-CoV-2 before being posted for surgery and after obtaining informed consent. Patients planned for surgery under general anesthesia underwent additional computed tomography of the chest. Testing strategies and outcomes were documented. **Results:** Out of a total of 413 patients who were given appointments for surgery during this period, nine patients (2.2%) were found to have positive RT-PCR for SARS-CoV-2, and their surgeries were postponed. The test positivity (prevalence) rate of asymptomatic COVID-19 infection among all elective vitreoretinal surgical patients in our hospital was 2.2%. None of the patients were symptomatic for COVID-19. **Conclusion:** Our results showed that among patients visiting high volume ophthalmic centers in the near future, approximately 1 in 45 patients may be asymptomatic, SARS-CoV-2 RT-PCR positive. Asymptomatic COVID-19 patients may lead to chances of transmission of the virus inside healthcare facilities among other visiting patients and healthcare workers.

**Key words:** Asymptomatic, COVID-19, preoperative testing, test positivity, transmission

The severe acute respiratory syndrome coronavirus 2 (coronavirus disease 2019) (SARS-CoV-2) (COVID-19) pandemic of 2020 has brought in sea changes and demands to the existing infrastructure of healthcare setups, both in terms of imparting specialized care to COVID-19 patients and prevention of the spread of infection to the healthcare professionals. Considering the great risk of transmission between patients and healthcare providers, healthcare institutions face enormous challenges in balancing patient's needs and simultaneous safety to the healthcare workers (HCWs).

Globally, approximately 28.4 million elective surgeries have been canceled due to disruption by the pandemic.<sup>[1]</sup> After more than 6 months into the pandemic, governments across the world have been trying to engage in discussion regarding how to restart elective medical and surgical procedures safely ensuring the protection of both the providers and the patients. A major challenge to this is that COVID-19 can present in the pre or asymptomatic transmission phase, and identifying patients with such conditions may be quite difficult. Hence, elective testing before surgeries has been proposed by international authorities, based on local transmission rate, type of surgery being done, and the amount of presumed exposure.<sup>[2]</sup> The Indian Council of Medical Research in June 2020 proposed that testing for COVID-19 for asymptomatic patients coming for elective surgeries should be performed for neurosurgery, ear-nose-throat surgery, dental procedures, etc.,

and for non-surgical interventions like bronchoscopy, upper gastrointestinal (GI) endoscopy, dialysis, etc.<sup>[3]</sup> Moreover, guidelines related to droplet precautions by operation room staff and other hospital workers have been carefully laid down.<sup>[4,5]</sup> However, no guidelines were proposed by any of the Indian government authorities specifically for eye-care centers before the study period. This study aimed at understanding the prevalence of asymptomatic COVID-19 infection among patients undergoing elective vitreoretinal surgeries at a tertiary care eye hospital and the associated challenges the future holds for the medical fraternity.

## Methods

This cross-sectional, observational study was performed in the vitreoretinal clinic of a tertiary care hospital in south India from July 16, 2020 to August 31, 2020. The study was done after taking clearance from the institutional ethics committee and it adhered to the tenets of the Declaration of Helsinki. Informed consent was taken from all patients before being included in this study, separately for the intervention and the COVID-19 testing.

At the hospital entry, each patient and attendant had to fill a COVID-19 questionnaire, which included questions related to

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Department of Retina-Vitreous Services, Aravind Eye Hospital, Madurai, Tamil Nadu, India

**Correspondence to:** Dr. Sagnik Sen, Department of Retina-Vitreous Services, Aravind Eye Hospital, Madurai, Tamil Nadu - 625020, India. E-mail: riksag@gmail.com

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their systemic health status (fever, cough, myalgia, headache, and throat pain), recent travel history, and any history of contact with COVID-19 positive patient or symptomatic patient. Each patient was triaged according to their ocular symptoms, signs, and previous history and escorted to the respective clinics. The clinic doctor would wear adequate personal protective equipment (PPE) while examining the patients on slit-lamps or during indirect ophthalmoscopy and minimizing patient interaction within 10–15 min, including examination and counseling.

The All India Ophthalmology Society had laid down preferred practice patterns to be followed during the pandemic in April 2020.<sup>[5]</sup> No guidelines for testing of patients coming for routine surgeries for COVID-19 were given by any Indian authority. Although there was a fair amount of confusion among practitioners worldwide regarding universal preoperative testing, all patients undergoing elective and emergency surgery at our retina clinic underwent preoperative reverse transcription-polymerase chain reaction (RT-PCR) testing for SARS-CoV-2 virus, considering the long duration of retinal surgeries and increased chances of transmission to the operating surgeons. Demographic data, nature of the surgical procedure, nature of screening test performed, and the outcomes were documented.

The patients were sent to a government allotted designated testing center for RT-PCR (Endocare Diagnostic Center, Madurai; approved for COVID-19 testing by the ICMR, registration number EDCMTN), who performed RT-PCR testing at 2500 INR. A trained technician collected oropharyngeal and nasopharyngeal swabs and transferred them into a transport medium for RT-PCR. The test was performed on real-time RT-PCR kits (SARAGENE™) using SARS-CoV-2 CoPrimer sets designed to detect RNA (RdRp gene) from the SARS-CoV-2 in the lower respiratory tract and upper respiratory tract. The limit of detection (LOD) was confirmed to be 600 copies in 140 µL of the specimen. All patients planned for surgery under general anesthesia also underwent additional compulsory computed tomography (CT) of the chest.

Elective surgeries had been resumed from July 16, 2020 with adequate preventive measures which included PPE for all HCWs, both in the clinic and the operation theatre, necessary PPEs for patients and attendants inside the premises, adherence to standard and universal precautions, adequate handwashing after patient exposures, and repeated thorough cleaning of slit-lamps, lenses, operation theatre tables, and floors. In case a patient came positive, the center's policy was to counsel the patient regarding the nature of the infection and then refer immediately to a nearby COVID facility for management, and request them to report back to the ophthalmic center after at least 2 weeks, along with a negative report for SARS-CoV-2 RT-PCR. This policy was followed even for ophthalmic emergencies like acute endophthalmitis or macula-on retinal detachments since our center was not a designated center capable of managing COVID-19 positive patients.

## Results

Between July 16, 2020 and August 31, 2020, a total of 413 patients were given appointments for elective surgery related to retina and vitreous [Table 1]. The pattern of daily COVID-19 positive cases in the district of Madurai has been summarized in Fig. 1.

The average age of all the patients given appointments for surgery was  $61.5 \pm 11.4$  years (range, 4–72 years) and 250 were males (60.5%) and 163 were females (39.5%).

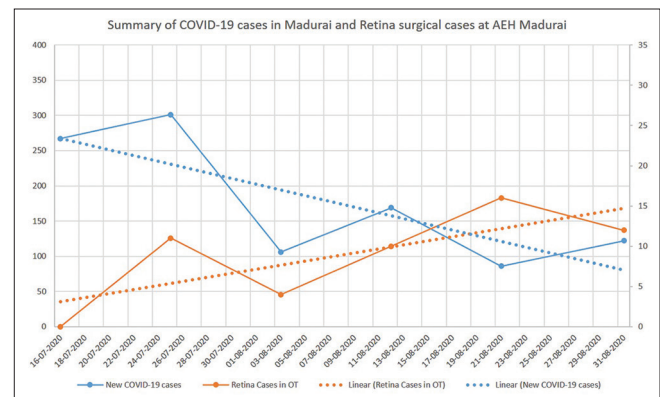
Overall, nine patients (2.2%) tested positive for RT-PCR for COVID-19 during this 6-week window, after which their surgeries were postponed and patients were asked to report to the center after 2 weeks with a negative COVID report. A total of 358 regional anesthesia procedures (86.7%) and 55 general anesthesia procedures (13.3%) were operated in the center during this period.

The prevalence rate of COVID-19 RT-PCR positivity was calculated as 2.2% of the total scheduled patients (approximately 1 in 45). The clinico-demographic profile of these patients has been summarized in Table 2. None of these RT-PCR positive patients were symptomatic of COVID-19 infection. An interesting point to be noted is that 5/9 patients (55.6%) who had a positive RT-PCR result were diabetic individuals and were on treatment for the same. Moreover, 6/9 patients (66.7%) individuals were equal to or above the age of 50 years. None of the chest CT scans in general anesthesia (GA) patients showed any COVID-related signs. One patient who had tested COVID-19 RT-PCR positive in the first week of July had come back to the center in the third week of July with a negative swab report and underwent a vitrectomy procedure, with adequate precautions.

## Discussion

The study was performed as a part of routine elective testing for COVID-19 among patients undergoing retinal surgeries (which generally last longer than other specialties), to evaluate the prevalence of asymptomatic COVID-19 infection among hospital patients undergoing elective surgery, to understand the magnitude of such cases the hospital might witness in the coming months, and also to make future preparations accordingly.

Asymptomatic COVID-19 is an emerging and serious public health issue considering the high contagiousness of the disease. Although a huge number of medical professionals and support



**Figure 1:** The blue line represents the number of new cases of COVID-19 in the district of Madurai from July 16, 2020 to August 31, 2020. The blue dotted line depicts the downgoing trend of daily new infections. The orange line represents the daily retinal surgeries performed at our center in the same period. The orange dotted line represents the upgoing trend of surgeries being performed throughout the lockdown period

**Table 1: Elective surgeries during the study period**

Surgery	Number of patients (n=413)
Retinal detachment surgery	100
Scleral fixation of intraocular lens	48
Surgery for diabetic vitreous hemorrhage and/or tractional retinal detachments	105
Silicone oil removal	97
Endophthalmitis surgery (core vitrectomy with antibiotic injection)	15
Others (macular holes, traumatic macular holes, non-resolving vitreous hemorrhage, advanced retinopathy of prematurity)	38

**Table 2: Clinico-demographic profile of patients who tested positive for COVID-19 RT-PCR**

Patient number	Diagnosis	Systemic status	Age/Gender
1	Vitreous hemorrhage (closed globe injury)	Diabetic	38/Male
2	Chronic endophthalmitis (cataract surgery 5 months back)	Diabetic, Hypertensive	65/Female
3	Total retinal detachment (chronic)	Diabetic	50/Female
4	Post open globe injury operated vitrectomy for the intraocular foreign body with silicone oil <i>in situ</i>	Hypertensive, Asthmatic	36/Male
5	Giant retinal tear with retinal detachment	-	50/Female
6	Subtotal retinal detachment (chronic)	Hypertensive	49/Male
7	Proliferative diabetic retinopathy with macula-involving tractional retinal detachment	Diabetic	55/Female
8	Posteriorly dislocated intraocular lens	Diabetic	82/Male
9	Operated retinal detachment for silicone oil removal	-	63/Female

staff have been deployed for the management of COVID-19 positive patients, a significant number is simultaneously involved in routine healthcare. According to the Centers for Disease Control and Prevention report, out of the 9282 COVID-19 cases among HCWs in the USA, 55% had exposure in the hospital setting.<sup>[6]</sup> A recent study by Chatterjee, *et al.* from India demonstrated that HCWs who are exposed to the airways and oral cavities of patients for prolonged periods such as dentists are at a greatest risk of infection.<sup>[7]</sup> Several reports of screening of HCWs for COVID-19 have highlighted the role of asymptomatic transmission of COVID-19.<sup>[8-13]</sup>

Evidence has shown that COVID-19 positive patients undergoing elective surgeries may have a higher risk of mortality than the general population, and surgery may accelerate and exacerbate disease progression of COVID-19.<sup>[14]</sup> Hence, it may be advisable to avoid elective surgeries in COVID-19 positive patients. However, the confusion has been multiplied by the issue of patients harboring asymptomatic COVID-19 infection. Almost 17.9–30.8% population has been observed to have asymptomatic infection.<sup>[15,16]</sup> One study compared disease course in asymptomatic and symptomatic patients of COVID-19 and found that around 17.2% of patients may be asymptomatic COVID-positive.<sup>[17]</sup> Authors found that asymptomatic patients may take lesser time to achieve negative conversion than the symptomatic population, and negative conversion within 20 days was also significantly higher in this group.<sup>[17]</sup> However, almost 50% of asymptomatic patients may not achieve negative conversion even after 2 weeks of diagnosis. Reports from China also have shown that almost 9.6% of residents in Wuhan who were never symptomatic, exhibited positive serology tests for COVID-19, indicating that they had an asymptomatic infection.<sup>[18]</sup>

Some studies have tried to evaluate the load of asymptomatic patients visiting healthcare facilities and also the risk of negative patients turning positive. In one such study, out of 2968 obstetric patients visiting hospitals repeatedly during the pandemic, 111 patients (3.7%) had tested positive for COVID, 45 antenatally, and 66 at the time of labor and delivery.<sup>[19]</sup> The authors also evaluated the association between the number of clinic visits and the risk of infection and found that the odds ratio was 0.93, indicating that in-person health visits were not likely to be an important risk factor for acquiring the infection. One study from the UK has evaluated the risk of death in asymptomatic COVID-19-negative patients admitted to hospitals for elective orthopedic surgery.<sup>[20]</sup> After considering the current disease prevalence, RT-PCR testing, and preassessment pathway, the authors found that patients had a 0.07% probability of getting COVID-19 infection with a false negative preoperative test (around 1 in 1400). Moreover, the risk of a patient with an undiagnosed infection being admitted for elective surgery and ending up dying from COVID-19 was estimated at around 1 in 7000. Considering a global infection fatality rate of 1.04%, they also estimated the risk of death to be around 1 in 140000, which was significantly low, even while assuming the worst-case fatality rate.

It can be challenging to identify patients who are carrying and spreading the virus while being asymptomatic. Hence, preoperative testing has been opted in several healthcare facilities across the world, with RT-PCR being the gold standard for testing. Antibody testing has not been proposed for perioperative screening, as antibodies develop in the second week of symptoms and many COVID-19 infected patients never develop detectable antibodies.<sup>[21,22]</sup> Moreover, antibody tests may cross-react with other coronaviruses, leading to



false-positive results, hence they have been advised against for perioperative testing by the World Health Organization (WHO) as well.<sup>[23]</sup>

Some authors have reported inadvertent COVID-19 suspicious findings in chest CT scans of patients undergoing elective procedures. In one such study, 2/31 patients (6.4%) had their procedures canceled due to possible COVID-19 findings on CT, although they were completely asymptomatic.<sup>[24]</sup> In another study including 167 patients, 3% of patients who initially had negative RT-PCR for COVID-19, but showed chest CT patterns suggestive of viral pneumonia, were isolated for presumed COVID-19. Repeat swab testing (second or third) for RT-PCR revealed infection in all of these patients. Hence, it has been suggested that in the context of typical clinical presentation and exposure to other individuals with COVID-19, CT features of viral pneumonia may be taken as a strong suspicion or COVID-19 infection even though RT-PCR results may suggest otherwise.<sup>[25]</sup> However, authors have also described occurrences of chest CT findings being negative for viral pneumonia also at the initial presentation.<sup>[26]</sup> Another study has shown that chest CT may be more sensitive than RT-PCR (98% vs 71%, respectively) for early detection of COVID-19 patients.<sup>[27]</sup> Authors have also shown that if RT-PCR is taken as a diagnostic criterion, CT imaging for COVID-19 may have a sensitivity of 97%, while if CT is taken as a diagnostic criterion, RT-PCR may show a sensitivity of 65% only.<sup>[28,29]</sup> Hence, it has been suggested that parallel CT chest and RT-PCR may be advised to make an accurate diagnosis for screening purposes, to improve the sensitivity and reduce the false-negative cases.<sup>[30]</sup> In our center, we performed a CT scan of the chest only for general anesthesia patients.

In a recently published study from our center, we have documented the change in practice patterns in the high-volume center due to the pandemic.<sup>[31]</sup> With the strict lockdown in place and blocking of inter-state borders, multiple patients could not visit the center in time for their necessary treatments or will be visiting the center in the coming days with further complications of their preexisting ocular pathologies. In this regard, the present study data further suggests that eye care centers may witness a significant number of asymptomatic COVID-19 cases in the days to come, which may put HCWs at risk of contraction of the disease, more so during prolonged surgeries and also during general anesthesia procedures. Based on the demographic profile of our patients, we can suggest that diabetic individuals above the age of 50 years may be potential carriers of asymptomatic infection and may be offered some form of preoperative testing.

The latest guidelines by the Ministry of Health and Family Welfare (MoFHW) dated August 19, 2020, have mentioned that presurgical COVID-19 test on patients is not mandatory, but a thorough history taking and examination must be performed to ensure that patient has a minute chance of having COVID infection; routine procedure/surgery is to be postponed in a COVID-19 suspect/confirmed case; staff needs to wear appropriate PPE as per MoFHW guidelines and the operating tables (OTs), floors, and equipment's are to be properly disinfected after each case.<sup>[32]</sup> Novel aerosol prevention box may be used to help prevent transmission in the OT both during general and regional anesthesia procedures.<sup>[33-35]</sup> Whether to go ahead with routine COVID-19 testing for all elective surgery

patients in eye care centers is finally at the discretion of the centers themselves, however, they should preferably adhere to strict protocols related to PPE usage and universal precautions while handling patients. Moreover, although ocular surgeries may be of significantly lesser duration than other surgical specialties, we must stress upon the fact that the turnover rate of surgeries in any large volume ophthalmic center is much higher than any other non-ophthalmological surgical center, warranting further precautionary measures.

A drawback of our study is that patients undergoing other types of ocular surgeries related to cataract, cornea, orbit, and glaucoma were not routinely tested for COVID-19, considering a lesser duration of surgeries. However, from Fig. 1, by looking at the total number of daily COVID-19 cases and by extrapolating the asymptomatic COVID data from retina surgeries, readers can get an idea about how much of the caseload may be expected in the months to come. We do recognize the fact that, while the actual duration of surgery may be short for routine anterior segment cases, the total time that a particular HCW is exposed to a patient can be longer than 15–20 min, especially the scrub nurse who may be preparing the case before the surgeon's arrival and may remain with the patient till the patient is shifted out of the operating room.

## Conclusion

In summary, we found that almost 1 in 45 patients coming for retina surgery may be asymptomatic carrier of COVID-19 infection. The chance of asymptomatic COVID-19 infected patients coming for elective ocular surgery may be reasonably high due to the high turnover of ophthalmic operation theatres, and HCWs and healthcare setups must be prepared and fully equipped to handle such situations in the near future, even after the stabilization of the pandemic.

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## Conflicts of interest

There are no conflicts of interest.

## References

1. Available from: <https://www.birmingham.ac.uk/news/latest/2020/05/covid-disruption-28-million-surgeries-cancelled.aspx>.
2. American College of Surgeons. Joint Statement: Roadmap for Resuming Elective Surgery after COVID-19 Pandemic. Available from: <https://www.facs.org/covid-19/clinical-guidance/roadmap-elective-surgery>. [Last accessed on 2020 Aug].
3. Indian Council of Medical Research. Newer Additional Strategies for COVID-19 Testing. Available from: [https://www.icmr.gov.in/pdf/covid/strategy/New\\_additional\\_Advisory\\_23062020\\_3.pdf](https://www.icmr.gov.in/pdf/covid/strategy/New_additional_Advisory_23062020_3.pdf). [Last accessed on 2020 Sep 02].
4. Vargas-Peirano M, Navarrete P, Díaz T, Iglesias G, Hoehmann M. Care of ophthalmological patients during the COVID-19 pandemic: A rapid scoping review. *Atención de pacientes oftalmológicos durante la pandemia COVID-19: Revisión panorámica rápida*. *Medwave* 2020;20:e7902.
5. Sengupta S, Honavar SG, Sachdev MS, Sharma N, Kumar A, Ram J, *et al*. All India Ophthalmological Society-Indian Journal of Ophthalmology consensus statement on preferred practices during the COVID-19 pandemic. *Indian J Ophthalmol* 2020;68:711-24.
6. Burrer SL, de Perio MA, Hughes MM, Kuhar DT, Luclhaupt SE,

- McDaniel CJ, *et al.* Characteristics of health care personnel with covid-19- United States, February 12- April 9, 2020, CDC covid-19 response team. *MMWR Morb Mortal Wkly Rep.* 2020; 69: 477-81
7. Chatterjee P, Anand T, Singh KJ, Rasaily R, Singh R, Das S, *et al.* Healthcare workers & SARS-CoV-2 infection in India: A case-control investigation in the time of COVID-19. *Indian J Med Res* 2020;151:459-67.
  8. Korth J, Wilde B, Dolff S, Anastasiou OE, Krawczyk A, Jahn M, *et al.* SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients. *J Clin Virol* 2020;128:104437.
  9. Bendavid E, Mulaney B, Sood N, Shah S, Ling E, Bromley-Dulfano R, *et al.* COVID-19 antibody seroprevalence in Santa Clara County, California. *MedRxiv* 2020. doi: 10.1101/2020.04.14.20062463.
  10. Steensels D, Oris E, Coninx L, Nuyens D, Delforge ML, Vermeersch P, *et al.* Hospital-wide SARS-CoV-2 antibody screening in 3056 staff in a tertiary center in Belgium. *JAMA* 2020;324:195-7.
  11. Poulidakos D, Sinha S, Kalra PA. SARS-CoV-2 antibody screening in healthcare workers in a tertiary centre in North West England. *J Clin Virol* 2020;129:104545.
  12. Kluytmans-van den Bergh MFQ, Buiting AGM, Pas SD, Bentvelsen RG, van den Bijllaardt W, van Oudheusden AJG, *et al.* Prevalence and clinical presentation of health care workers with symptoms of coronavirus disease 2019 in 2 Dutch hospitals during an early phase of the pandemic. *JAMA Netw Open* 2020;3:e209673.
  13. Keeley AJ, Evans C, Colton H, Ankcorn M, Cope A, State A, *et al.* Roll-out of SARS-CoV-2 testing for healthcare workers at a large NHS Foundation Trust in the United Kingdom, March 2020. *Euro Surveill* 2020;25:2000433.
  14. Kaye K, Paprottka F, Escudero R, Casabona G, Montes J, Fakin R, *et al.* Elective, non-urgent procedures and aesthetic surgery in the wake of SARS-COVID-19: Considerations regarding safety, feasibility and impact on clinical management. *Aesthetic Plast Surg* 2020;44:1014-42.
  15. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan. *Euro Surveill* 2020;25:2000180.
  16. Nishiura H, Kobayashi T, Miyama T, Suzuki A, Jung SM, Hayashi K, *et al.* Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). *Int J Infect Dis* 2020;94:154-5.
  17. Uhm JS, Ahn JY, Hyun JH, Sohn Y, Kim JH, Jeong SJ, *et al.* Patterns of viral clearance in the natural course of asymptomatic COVID-19: Comparison with symptomatic non-severe COVID-19. *Int J Infect Dis* 2020;99:279-85.
  18. Wu X, Fu B, Chen L, Feng Y. Serological tests facilitate identification of asymptomatic SARS-CoV-2 infection in Wuhan, China. *J Med Virol* 2020. doi: 10.1002/jmv. 25904.
  19. Reale SC, Fields KG, Lumbreras-Marquez MI, King CH, Burns SL, Huybrechts KF, *et al.* Association between number of in-person health care visits and SARS-CoV-2 infection in obstetrical patients. *JAMA* 2020;324:1210-2.
  20. Kader N, Clement ND, Patel VR, Caplan N, Banaszkiwicz P, Kader D. The theoretical mortality risk of an asymptomatic patient with a negative SARS-CoV-2 test developing COVID-19 following elective orthopaedic surgery. *Bone Joint J* 2020;102-B: 1256-60.
  21. Zhao J, Yuan Q, Wang H, Liu W, Liao X, Su Y, *et al.* Antibody responses to SARS-CoV-2 in patients of novel coronavirus disease 2019. *Clin Infect Dis* 2020;ciaa344. doi: 10.1093/cid/ciaa344.
  22. Okba NMA, Müller MA, Li W, Wang C, GeurtsvanKessel CH, Corman VM, *et al.* Severe acute respiratory syndrome coronavirus 2-specific antibody responses in coronavirus disease patients. *Emerg Infect Dis* 2020;26:1478-88.
  23. World Health Organization. Advice on the use of point-of-care immunodiagnostic tests for COVID-19 [Last updated on 2020 Aug 04].
  24. Ikehara H, Gotoda T, Kusano C. Chest computed tomography for severe acute respiratory syndrome coronavirus 2 infection screening for COVID-19 before emergency and elective upper endoscopy: A pilot study. *Dig Endosc* 2020. doi: 10.1111/den. 13789.
  25. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical coronavirus disease 2019 (COVID-19) pneumonia: Relationship to negative RT-PCR testing. *Radiology* 2020;296:E41-5.
  26. Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, *et al.* CT imaging features of 2019 novel coronavirus (2019-nCoV). *Radiology* 2020;295:202-7.
  27. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, *et al.* Sensitivity of chest CT for COVID-19: Comparison to RT-PCR. *Radiology* 2020;296:E115-7.
  28. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, *et al.* Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: A report of 1014 cases. *Radiology* 2020;296:E32-40.
  29. Lei X, Wang J, Yang Z, Zhou S, Xu Z. Diagnostic value of pleural effusion mononuclear cells count and adenosine deaminase for tuberculous pleurisy patients in China: A case-control study. *Front Med (Lausanne)* 2019;6:301.
  30. Wang Y, Hou H, Wang W, Wang W. Combination of CT and RT-PCR in the screening or diagnosis of COVID-19. *J Glob Health* 2020;10:010347.
  31. Babu N, Kohli P, Mishra C, Sen S, Arthur D, Chhablani D, *et al.* To evaluate the effect of COVID-19 pandemic and national lockdown on patient care at a tertiary-care ophthalmology institute. *Indian J Ophthalmol* 2020;68:1540-4.
  32. Ministry of Health and Family Welfare, Government of India. Guidelines on Safe Ophthalmology Practices in Covid-19 Scenario. Available from: <https://www.mohfw.gov.in/pdf/GuidelineforEyeCare.pdf>. [Last accessed on 2020 Sep 01].
  33. Jaichandran VV, Raman R. Aerosol prevention box for regional anaesthesia for eye surgery in COVID times. *Eye (Lond)* 2020;1-2. doi: 10.1038/s41433-020-1027-5.
  34. Brown S, Patrao F, Verma S, Lean A, Flack S, Polaner D. Barrier system for airway management of COVID-19 patients. *Anesth Analg* 2020;131:e34-5.
  35. Lai Y, Chang C. A carton-made protective shield for suspicious/confirmed COVID-19 intubation and extubation during surgery. *Anesth Analg* 2020;131:e31-3.