Coronaviruses are positive-strand enveloped nucleocapsid RNA viruses. They are divided into 4 genera: alpha, beta, gamma and delta based on genomics and serology. 10% to 30% of all upper respiratory tract infections in adults are linked to coronaviruses. Four human coronaviruses (HCoVs) namely HCoV 229E, NL63, OC43, and HKU1 have become endemic globally. From the turn of the millennium major epidemics by zoonotic HCoVs have been reported which manifested as Severe Acute Respiratory Syndrome (SARS) in 2002-3 and the Middle-East-Respiratory-Syndrome (MERS) in 2012. Humans are competing with wild animals invading their shrinking wild habitats and therefore the zoonotic infections are an inevitable result. The 2020 pandemic due to novel coronavirus 2019 (nCoV 2019) was reported from a cohort of patients with pneumonia traced to Huanan Seafood Market at Wuhan the capital of Hubei Province in China. Novel coronavirus 2019 or Covid-19 infections were mostly mildly symptomatic and self-limiting but acute respiratory distress syndrome (ARDS) requiring ventilation was reported in 5 to 10% of individuals. Mortality and complications were higher in advanced ages. The reports of a bilateral ground glass appearance in lower lungs on computed tomography and a cytokine storm was also reported by some authors. Multiorgan dysfunction syndrome and myocarditis have also been reported in recent studies. The current pandemic resulted in over half of the world being locked down. Different countries tried different approaches to battle the virus with varying results. Now the world looks to life after the pandemic. The economies are under threat of recession and even deflation. The healthcare sector is also looking to resume its elective or need based services. The clarion call has come from the Ophthalmology chains which are faced with the threat of liquidity. Heightened risks during surgery were reported in the literature and apprehensions were expressed by the experts in the past. Covid-19 is transmitted through particles or droplets in the air. The anesthetists, ophthalmologists, dentists and otorhinolaryngologists were reported to be at higher risk of contracting the disease especially so when they...
carried out procedures that generated aerosols. There were reports of otorhinolaryngologists on ventilators in Britain suspected of contracting the virus through contact with asymptomatic Covid-19 patients. The patient, surgical team and surgeon wear a sterile clothing along with the usual scrubs and thus would be deemed to be protected. But the problem is something different. The air conditioning in these theatres classically uses 80 percent recirculated air to cut on costs. The temperature and relative humidity are kept at 210 C ± 30C and 20 to 60 percent relative humidity. Aerosols can leave the virus almost everywhere, and they can persist on plastic, metal and cardboard for varying durations. The virus can be present for up to several days on some surfaces. Classically the fumigation procedures would be carried out at the end of the week or end of day in some cases with medical ultraviolet light irradiation. It is not possible to clean the air or surfaces between surgeries.

Discussion
Operating rooms are sterile environments. But that is at the start of the work day. Once aerosols are generated by the drills of the orthopedists or handpieces of the ophthalmologists and the air is affected then we need to consider the air conditioning where the fan that sucks in and circulates the air in the operating theater. The current recommendation of using one hundred percent fresh air thus will have some impact and has some merit. However, Dr Alister Hart, a Briton operating at Britain’s largest orthopaedic hospital, contends that if a patient happens to be infected with Covid-19, even if he is asymptomatic then the combination of power tools, high-velocity splatter and ventilation systems can produce a viral wind tunnel. “If the theater has had anyone with the virus in it during the previous 72 hours the airborne aerosol could have landed on some surface,” including the ceiling. Even with most stringent cleaning protocols it is impossible to prevent this. According to him the implication is that “very soon all our operating theaters will be covered in Covid-19. And then you switch on the ventilation and you blow it all over the place” and operating rooms will become “viral labs in a wind tunnel” unless we address these concerns. So it appears that soon the “new normal” will have to take this into account.

The air conditioning team responded by recommending 25 air changes per hour and a negative pressure inside the operation theatre. They added some extra ones like using 40-60 percent humidity and setting the temperature at 24-30 degrees centigrade. This response was typical of an industry trying to apply quick fix solutions without actually engaging with the stakeholders. These recommendations found their way into the guidelines of some professional bodies also. What no one realized was that negative pressure operation theatres were prescribed for infected cases and have been there since ages. In ophthalmology, it opened a Pandora’s box. Now the negative pressure means that air from the surroundings will find its way into the operation theatre though the air curtains and this is definitely more contaminated than the treated air from the air handling unit over the operating table. The wind tunnel now has another source of adding contagion.

One solution to the problem is using close to zero pressure ventilation systems. This means that the split air conditioners and window units are now useful again if we can ensure disinfection, which we cannot. The second, a little less elegant solution is the use of a venting mechanism with a containment just next to the operation theatre. It is a satisfactory solution if the vented air is treated and vented out at least three feet or more above the inlet. That has still not addressed the question that the paper had raised. One solution is negative pressure hood over the aerosol generating area.

Covid-19 can be transmitted even by those without symptoms which makes this pandemic different from the previous coronavirus infections. Face masks cannot provide sufficient protection. One patient undergoing surgery in Wuhan infected 14 health care workers before a fever was even registered. No unified hospital protocol for managing the coronavirus within surgical settings has been validated and most of the talks are in the realms of conjecture.

The world is trying to grapple with the definition of full PPE in this pandemic. A full-body, light plastic protection with goggles and face shields is the
Chinese version of full PPE. It leaves very little surface area of the body exposed to receive aerosol droplets. This is clearly very uncomfortable over any extended period of time.

Asymptomatic transmission and virus survival on surfaces makes this dangerous for the health professionals. The “viral load” in these settings in surgeons tends to be greater than those who pick the virus up in the community from touching an infected surface and then touching their faces. Whether a higher dose is linked to cytokine storms, in which the body’s own defenses overreact, cause inflammation and wreak havoc in the lungs is still unknown. The mounting evidence seems to suggest that doctors are being exposed to a high-risk environment without proper protection. And no it is not about shortages. They add another dimension to the problem but it has largely been addressed on the scientific forums at least. We are some distance from clarity on what constitutes correct procedure for respirator reuse as the world has acknowledged that we need to find ways to make it last longer or find some more permanent methods.

Universal precautions are the best way forward. All patients, unless proven otherwise, are assumed to have the disease and surgeons take the appropriate precautions. The only problem here is that how do we test the surgeon and his team every time before he enters the operating room.

It does appear that the days of mindless factory style conveyor belt surgery with seventy cases scheduled for a single day may actually not be coming back for several years to come most probably. The results of the drum experiment that demonstrated the persistence for three hours may not be applicable to real life situations, nor would the knowledge of minimum infective dose really be forthcoming for sometime at least. Therefore, it is safe to presume that need based surgery would be a paradigm coming up as even the elective surgery would have to be triaged. Urgently answering the questions like, “are phacoemulsification and vitrectomy surgeries to be considered aerosol generating on the basis of simulation studies” and “is business process redesign to address the air inside the operation theatre relevant to practice of today” is of prime importance with at least some strong evidence. The economic impact of the lockdown is being felt by practices which used debt to grow and the aftershocks of the debt to growth models leveraged very well by the ophthalmic support and logistics microenvironment are being felt by the manufacturers and practitioners alike. However, there is a word of caution as we move towards reopening our practices. The lawsuits can be far more damaging and expensive than the losses incurred by the lockdown.

**Conclusion**

A cautious and calibrated response based on evidence is the need of the hour. Any clairvoyant guidelines or position statements can at best be deprecated and at worst be detrimental to the interests of the ophthalmologists at large. The discussions should involve the stakeholders and scientific evidence should be evaluated dispassionately before any major changes are envisaged.

**References**


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