



INCIDENCE AND SEVERITY OF COVID-19 IN ANESTHESIOLOGISTS IN TERTIARY CARE TEACHING HOSPITALS IN A METROPOLITAN CITY

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ABSTRACT **Background and aims:** Anaesthesiologists have worked tirelessly along with the physicians during the COVID-19 pandemic. They were involved in many aerosol-generating procedures, leading to an elevated risk of acquiring COVID-19. However, the magnitude of this risk was unknown. We aimed at recording the incidence, severity, source of COVID-19 in anaesthesiologists, to analyse and plan strategies to protect them. **Methods:** We conducted a retrospective and prospective observational study from March 2020 to January 2022. Questionnaire Google forms were e-mailed to all anaesthesiologists working in the state run tertiary care teaching hospitals in Mumbai and were asked to enter details regarding covid infection, its possible source, the severity of infection and vaccination. Data collected were expressed as numbers and proportions to calculate incidence. **Results:** Out of 156 anaesthesiologists who participated in the survey, the incidence of COVID-19 infection was 44.9%(70). None of them had severe symptoms and no mortality was seen. 95.7%(67) had mild symptoms and 4.3%(3) had moderate symptoms of COVID. 34.3%(24) were infected with COVID-19 before vaccination, 10%(7) were infected post 1st dose of vaccination and 55.7%(39) were infected post 2nd dose. 21.42%(15) anaesthesiologists considered working in the Covid Intensive Care Unit as the most probable cause of their covid infection while 72.8%(51) considered contact with asymptomatic patients or colleagues during the incubation period as the most probable reason for their infection. **Conclusion:** The frequency and severity of COVID-19 can be reduced among anaesthesiologists by highlighting the importance of hand hygiene, appropriate use of Personal Protective Equipment, social distancing at work and vaccination.

KEYWORDS : COVID-19, chemoprophylaxis, anaesthesiologists, Incidence, vaccination

Introduction

The world is grappling with COVID-19 since March 2020 and it has taken a toll on the health care workers(HCW) all over the world. Since then the world has faced three waves of COVID-19, each one registering a higher peak than the previous one because of the different variants of the coronavirus. The first wave lasted approximately for 7-8 months followed by the second wave which lasted for around four months.^[1] The third wave was the shortest and lasted for only two months.

Anaesthesiologists represent a high risk for COVID-19 due to their working environment. They come in close contact with the patients while working in the Covid Intensive Care Units(CICU) and operation theatre(OT). Some of the greatest risks involved are aerosol-generating procedures(AGP) like intubation. In response, interventions such as the appropriate use of personal protective equipment(PPE) and specific procedural techniques^[2] have been implemented. Similar studies have been done previously in HCWs in different countries.^[3,4]

The objective behind this audit was to better understand the risks faced by anaesthesiologists while attending patients with suspected or confirmed COVID-19. The data showing incidence and severity of COVID-19 in anaesthesiologists can inform physicians and policy-makers the potential risks of COVID-19 and will help in planning strategies to protect them.

Methods

We conducted a retrospective and prospective audit from the beginning of the COVID-19 pandemic, March 2020 to January 2022 to record the incidence of COVID-19 in anaesthesiologists working in the state run four tertiary care teaching hospitals in Mumbai city. Approximately 400 anaesthesiologists work in these hospitals including junior and senior residents, assistant professors, associate professors and professors. A questionnaire including 30 closed and open ended questions was designed for the same. Questionnaire comprised of questions that included basic epidemiological data, designation, nature of the workplace, details regarding covid infection,

its possible source and severity of infection, vaccination, the use of protective guard against covid, and its transmission while working in CICU, covid ward and OT. Questionnaire forms were analysed and validated for relevance, clarity, simplicity, and ambiguity, on a four-point scale for each parameter, for each question, by five independent senior anaesthesiologists and a senior neurosurgeon. After validation, it was formulated as a Google questionnaire form.

After institutional ethics committee approval in November 2021, anaesthesiologists were invited to participate and fill the self-administered Google forms through their email addresses and through other social media platforms such as WhatsApp. Consent was sent to all anaesthesiologists along with the Google forms. The responses were collected from November 2021 to January 2022. Those who refused to answer the questionnaire were excluded from the study. The identity of each respondent was kept confidential. The anaesthesiologists were regularly motivated and reminded through WhatsApp to fill the Google forms on voluntary basis. Data regarding mortality was directly collected from the head of department of the respective hospital.

Statistical analysis

The principal and co-investigators did the compilation and analysis of the data. A database was created on a Microsoft Office Excel spreadsheet. The data was analysed in percentage with the formula,

Incidence rate = the number of anaesthesiologists infected during the time period divided by the total number of anaesthesiologists who participated in the study from the four tertiary care teaching hospitals.

Results

Out of 400 anaesthesiologists, 156(39%) participated in the survey. Out of 156, the incidence of COVID-19 infection in anaesthesiologists was 44.9%(70), of which 4.5%(7) respondents were affected more than once. Four(57.1%) anaesthesiologists were infected twice post 2nd dose of vaccination, two(28.6%) of them were infected twice before vaccination and one(14.3%) anaesthesiologist was infected once before vaccination and once post 2nd dose of vaccination.

95.7%(67) had mild (asymptomatic or symptoms such as fever, cough, sore throat, nasal congestion or headache without evidence of breathlessness or hypoxia) symptoms and 4.3%(3) had moderate (pneumonia with no signs of severe disease with the presence of dyspnoea and/or hypoxia, fever, cough, including a SpO₂ range 90–94% on room air and a respiratory rate \geq 24/min) symptoms of covid. None of them had severe (pneumonia plus one of the following: respiratory rate $>$ 30 breaths/min, severe respiratory distress or SpO₂ $<$ 90% on room air).^[5] No mortality was seen. 52.3%(35) of the anaesthesiologists suffering with mild covid symptoms were home quarantined and the remaining 47.7%(32) were admitted in covid ward. Those having moderate symptoms were admitted in CICU for a mean value of 10.66 days and required 2–4 Litre min⁻¹ oxygen support via nasal cannula. They were given five doses of Remdesivir. All of them acquired the infection before vaccination.

The demographic details are mentioned in Table 1. All questionnaires were complete filled. Among their areas of work, 100% of the anaesthesiologists were attending to patients in the OT, but a large proportion of them, were also providing anesthesia services to patients in the CICU(78.9%) and in the covid ward(41.6%). 21.8%(34) anaesthesiologists had comorbidities. Amongst them, 8.3%(13) of anaesthesiologists were hypertensive, 8.3%(13) were having hypothyroidism, 7%(11) were suffering from obesity, 5.1%(8) were having bronchial asthma, 3.8%(6) were diabetic and 0.6%(1) was suffering from ischemic heart disease.

Chemoprophylaxis was taken by 39.1%(61) of the respondents during the first wave of COVID-19, of which Hydroxychloroquine(HCQ) was taken by 91.8%(56) respondents, while 3.2%(2) of them were using alternative chemoprophylaxis like Favipiravir. 3.2%(2) used Doxycycline and 1.6%(1) used Ivermectin as chemoprophylaxis.

During the pandemic, guidelines were implemented regarding the use of PPE. From the 123 anaesthesiologists working in the CICU, 100% used N-95 mask as a protective guard. Apart from N-95, 100% used PPE (gown; gloves; shoe covers, eye protection; and three-ply masks). 98.3%(121) used face shield while working in CICU. Most frequently, the anaesthesiologists, followed alcoholic hand-rub(98.3%), change of gloves(82.9%) or washed their hands(71.5%) as hand sanitation practice while working in CICU. In OTs, most of the anaesthesiologists used N-95 mask (96.8%) and face shield(72.3%). Only 42.3% used PPE while working in OT. 74.3%(52) isolated themselves in a separate room while working in CICU.

Among the 156 participants, 123(78.8%) anaesthesiologists received 2 doses of Covishield and 25(16%) of them had taken Covaxin 2 doses. 4(2.6%) anaesthesiologists had taken only 1st dose of Covishield and 2(1.3%) had taken only 1st dose of Covaxin. A total of 72(46.1%) non-serious adverse events were reported within 48 hours of the first dose of vaccination. Common adverse events seen were fever and myalgia (n-39, 25%), headache (n-5, 3.2%), only fever with chills (n-14, 8.9%), pain at site of injection (n-4, 2.6%) and only myalgia (n-9, 5.8%). No adverse events were reported in 82(52.6%) anaesthesiologists. Only 24(15.38%) anaesthesiologists reported non-serious adverse events within 48 hours of the second dose of vaccination. 18(75%) anaesthesiologists reported pain at injection site along with myalgia. Remaining six(25%) anaesthesiologists suffered only pain at injection site. Of the 70 anaesthesiologists infected with COVID-19, 34.3%(24) were infected before vaccination, 10%(7) were infected post 1st dose of vaccination and 55.7%(39) were infected post 2nd dose. Most of the respondents (n=5, 71.4%) infected post 1st dose of vaccination were diagnosed as covid positive after 1 week. 41%(16) infected post 2nd dose of vaccination, came positive after 8 to 11 months. From the 70 anaesthesiologists who got infected, 64.3%(45) anaesthesiologists gave history of covid in family or room partners at the same time. 72.8%(51) considered contact with asymptomatic patient or colleagues during incubation period as the most probable reason for their covid infection while 21.42%(15) anaesthesiologists considered working in the CICU as the most probable cause of their covid infection.[Fig 1]

Post covid sequelae are symptoms that persist after recovering from COVID-19. Most of the symptoms persisted till one month affecting the quality of life. Most common(68.6%) post covid sequelae seen in our study was fatigue and myalgia. Neuronal inflammation mediated by direct invasion of virus explains the persistence of symptoms like fatigue and myalgia.^[6] Many(11.4%) suffered from mood disorders like anxiety and depression.[Fig 2]

Discussion

Healthcare workers (Physicians, anaesthesiologists, otorhinolaryngologists and chest physicians) are at increased risk of covid infection as they come in close contact with patients infected with covid while working in the CICU and covid ward. In India, given the deficit of trained HCW in proportion to the vast population and an already overburdened public health system; covid infection in HCW especially an anaesthesiologist would lead to loss of manpower. This could eventually impact the management of critically ill patients infected with COVID-19. Therefore, evaluation of infection rates in these groups is indicated to strategize plans for their protection. Present study will give an insight about the proportion of anaesthesiologists infected with COVID-19 and the severity of infection since the beginning of the pandemic. This study may become increasingly relevant as further waves of Covid-19 outbreaks emerge, allowing a comparative understanding of changes in practice and risk of anaesthesiologists. Figure 3 depicts the hierarchy of controls to identify the best strategies against COVID-19.^[7] Key factor in decreasing the rate of infection is following infection prevention and control policies.^[8]

In our study the incidence of COVID-19 in anaesthesiologists was 44.9% which is comparatively higher than the other audits conducted in HCWs worldwide. This could be because of the constant involvement of anaesthesiologists in the treatment of covid positive patients in the OT, CICU and covid ward, and inclusion of the third wave which was because of the highly infectious Omicron variant. Mahesh Goenka et al. carried out an audit of COVID-19 infection in the gastroenterology department of a tertiary care teaching institute during the 1st wave and saw an incidence of 42.86% of Covid-19 infection in those working in critical care unit.^[9]

In our study, from the 21.8%(34) anaesthesiologists with comorbidities, 55.9%(19) were infected with mild symptoms and only 5.9%(2) were infected with moderate symptoms of COVID-19. Parameswaran et al. carried out a survey and found that increasing age, presence of pre-existing medical comorbidities, and daily exposure to COVID-19 patients were associated with increased severity of COVID-19 infection.^[10] According to our institution protocols, young anaesthesiologists without comorbidities and senior faculty up to 55 years of age with mild comorbidities were given CICU and covid ward duties. Elderly anaesthesiologists with or without comorbidities were given duties in the OT to avoid direct exposure to the virus.

The role of hydroxychloroquine(HCQ) prophylaxis for preventing COVID-19 is still controversial, with previous studies showing both favourable and unfavourable outcomes.^[9,11] In our study, from the 91.8%(56) anaesthesiologists who took HCQ as chemoprophylaxis, only four of them got infected with mild symptoms during the 1st wave. Further studies will be required to see the correlation of HCQ prophylaxis with the incidence and severity of COVID-19.

All four hospitals carried out RTPCR test of patients undergoing elective procedures within 48 to 72 hours of taking patient to the OT which could be the reason behind less use of PPE while working in OT. The crowded vaccination centres that could not maintain social distancing and only partial immunity after 1st dose of the vaccination could be the cause of covid post 1st dose of vaccination. Majority of the anaesthesiologists were infected during the third wave of covid due to the Omicron variant which was highly infective and reduction in immunity provided by the vaccine.^[1] Antibody titres were not available, hence we could not co-relate it with immunity.

In our study we saw that, most of the anaesthesiologist considered contact with asymptomatic patient or colleague during the incubation period as the most probable cause of their infection. Lack of Covid appropriate behaviour and carrying out AGPs in the OTs and CICU without HEPA filter and vacuum mechanism at the time of contact with asymptomatic patient could have led to the infection. The use of aerosol containment devices like the intubation box with vacuum filtering system could have effectively reduced the spread of aerosols.^[12] Only 21.42% anaesthesiologist considered working in the CICU as the most probable reason for their covid infection. This could be because of the appropriate use of PPE and optimal hand hygiene while working in the CICU.

Every institute should form a consensus guideline to manage airway in COVID-19 infected patients. An AGP is defined as any medical

procedure that can induce the production of aerosols of various sizes, including small (<5µm) particles.^[13] A systematic review of infection risk to HCWs, based on limited literature, ranked airway procedures in descending order of risk as: (1), tracheal intubation; (2), tracheostomy(emergency front-of-neck airway (FONA)); (3), non-invasive ventilation(NIV); and (4), mask ventilation. Other potentially aerosol-generating procedures include: tracheal extubation; cardiopulmonary resuscitation (before tracheal intubation); bronchoscopy; and tracheal suction without a 'closed in-line system.'^[2] Therefore, anaesthesiologists working in the CICU and OT are at a higher risk of getting infected with covid as they conduct all these procedures.

COVID-19 vaccines have been suggested to elicit immune response and reduce the predisposition to infections as well as severe disease. Reinfections as well as infections post vaccination, were also documented in our study. Covid infection post vaccination was highly seen in anaesthesiologists potentially due to their high exposure. Bergwerk et al. correlated the occurrence of breakthrough infections in fully vaccinated HCWs with neutralizing antibody titers during the peri-infection period.^[14] Chia PY et al. in his study found that vaccinated people are less likely to develop severe symptoms, more likely to recover quickly, and much less likely require hospitalization compared with unvaccinated people.^[15]

In our study, all anaesthesiologists infected with covid post vaccination had mild symptoms.

Some limitations in our study must be discussed. Firstly, as anaesthesiologists involved in covid patient care may be exposed to COVID-19 from various other sources, probable source per se cannot be demonstrated. Secondly, asymptomatic carriers were not accounted for. Thus, the true incidence of infection may have been underestimated. Thirdly, there is a risk of sampling bias from the voluntary nature of participation, and the anaesthesiologists engaging in this study may represent a small subset of the larger community. Lastly, the lack of a control group hampers our full ability to compare these findings.

Conclusion

Anaesthesiologists face significant risk from COVID-19 as they are constantly involved in AGPs in OT and CICU. This audit will help in reducing the incidence and severity of covid in the future waves of COVID-19 by highlighting the importance of the use of appropriate PPE, hand hygiene, self-isolation, and vaccination while working in the CICU, OT and covid ward.

Table 1 Demographics and Basic details

Parameter	Frequency	Percentage (%)
1) Age		
21-30	99	63.5
31-40	30	19.2
41-50	19	12.2
51-60	7	4.5
>60	1	0.6
2) Sex		
Female	105	67.3
Male	51	32.7
3) Designation		
Junior Resident	74	47.4
Senior resident	36	23.2
Assistant professor	20	12.8
Associate professor	14	9.0
Professor	12	7.6
4) Years of experience		
<5	114	73.2
5-10	13	8.3
10-20	16	10.2
>20	13	8.3

Figure legends

Figure 1-Anaesthesiologists considered the following as the most probable reason for their Covid-19 infection.

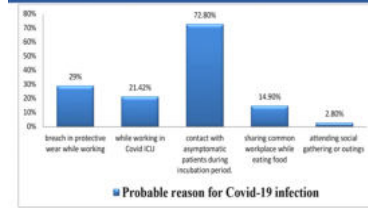


Figure 2-Post covid sequelae after recovering from COVID-19.

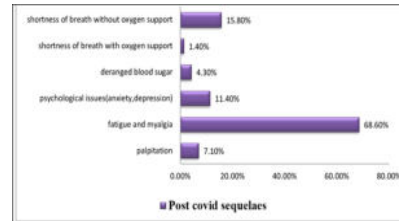
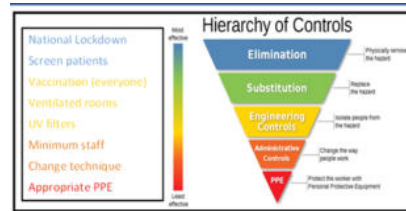


Figure 3-NIOSH Hierarchy of controls can be used to deploy effective strategies against Covid-19.



REFERENCES

- Mandal S, Arinaminpathy N, Bhargava B, Panda S. Plausibility of a third wave of COVID-19 in India: A mathematical modelling based analysis. Indian J Med Res 2021;153:522-7.
- Cook TM, El-Boghdady K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. Anaesthesia 2020;75:785-799.
- Mahajan NN, Mathe A, Patokar GA, Bahirat S, Lokhande PD, Rakh V, et al. Prevalence and clinical presentation of COVID-19 among healthcare Workers at a Dedicated Hospital in India. J Assoc Physicians India 2020:16-21.
- Sabetian G, Moghadami M, Haghghi LH, Shahririrad R, Fallahi MJ, Asmarian N, et al. COVID-19 infection among healthcare workers: a cross-sectional study in southwest Iran. Virol J 2021;18:1-8.
- Dev N, Meena RC, Gupta DK, Gupta N, Sankar J. Risk factors and frequency of COVID-19 among healthcare workers at a tertiary care centre in India: a case-control study. Trans R Soc Trop Med Hyg 2021;115:551-6.
- Naik S, Halder SN, Soneja M, Mundadan NG, Garg P, Mittal A, et al. Post COVID-19 sequelae: A prospective observational study from Northern India. Drug Discov Ther 2021;15:254-260.
- University C. COVID-19 hierarchy of controls. 2020. Available from: <https://ehs.comell.edu/campus-health-safety/occupational-health/covid-19/covid-19-hierarchy-controls>
- Mansoor S, Sharma KA, Ranjan P, Singhal S, Meena J, Kumari R, et al. A descriptive audit of healthcare workers exposed to COVID-19 at a tertiary care center in India. Int J Gynaecol Obstet. 2021;153:393-7.
- Kumar Goenka M, Bharat Shah B, Goenka U, Das SS, Afzalpurkar S, Mukherjee M, et al. COVID-19 prevalence among health-care workers of Gastroenterology department: An audit from a tertiary-care hospital in India. JGH Open 2021;5:56-63.
- Parameswaran A, Apsingi S, Eachempati KK, Dannana CS, Jagathkar G, Iyer M, Aribandi H. Incidence and severity of COVID-19 infection post-vaccination: a survey among Indian doctors. Infection. 2022;7:1-7.
- Hernandez AV, Roman YM, Pasupuleti V, Barboza JJ, White CM. Update Alert: Hydroxychloroquine or Chloroquine for the Treatment or Prophylaxis of COVID-19. Ann Intern Med 2020;173:W78-W79.
- Patwa A, Shah A, Garg R, Divatia JV, Kundra P, Doctor JR, et al. All India difficult airway association (AIDAA) consensus guidelines for airway management in the operating room during the COVID-19 pandemic. Indian J Anaesth. 2020 ;64:S107-S115.
- World Health Organization. Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed. Published June 29, 2020. Accessed November 2, 2020. <https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2020.4>
- Bergwerk M, Gonen T, Lustig Y, Amit S, Lipsitch M, Cohen C, et al. Covid-19 breakthrough infections in vaccinated health care workers. N Engl J Med 2021;385:1474-84.
- Chia PY, Ong SW, Chiew CJ, Ang LW, Chavatte JM, Mak TM, et al. Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine breakthrough infections: a multicentre cohort study. Clin Microbiol Infect 2022;28:612-e1.