

Original Research Article

The effect of COVID-19 infection on nasal mucociliary clearance in health care workers in tertiary care hospital: a cross sectional study

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ABSTRACT

Background: Mucociliary clearance is the primary innate defence mechanism of the respiratory tract and protects the respiratory tract from foreign bodies such as small particles, dust, and pathogens. The saccharin test is a useful screening technique for measuring nasal mucociliary clearance as it is inexpensive, simple to do, and reproducible. The objective of the study was to determine whether severe acute respiratory syndrome (SARS-CoV-2) (COVID-19) has an effect on nasal mucociliary clearance.

Methods: Our study was conducted in 100 health care workers. In these 50 health care workers, with post covid status of 2 weeks, who were tested positive for SARS-CoV-2 by RTPCR, has taken as cases. 50 health care workers without SARS-CoV-2 infection taken as control group. The mucociliary clearance assessed by calculating NMC time using saccharine test.

Results: We did not find a statistically significant difference between the groups in terms of NMC duration.

Conclusions: Mucociliary clearance is an important airway defence mechanism. though few viral infections prolong the NMC duration, in our study, we did not find a statistically significant difference between the groups in terms of NMC duration. There was no correlation between age, sex, covid symptoms (loss of smell/taste) and NMC.

Keywords: Nasal mucociliary clearance, Saccharin test, SARS-CoV-2, COVID-19

INTRODUCTION

In December 2019, Coronavirus Disease 2019 (COVID-19) outbreak occurred in Wuhan, Hubei Province, China and spread rapidly throughout China, and then emerged around the world. On February 12, 2020, World Health Organization (WHO) named the disease caused by the novel coronavirus as COVID-19. Clinical evidence has shown that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can be transmitted by person-to-person.^{1,2} The disease begins with the proliferation of the virus taken through the respiratory tract by attaching to the oropharyngeal or nasopharyngeal mucosa and causing an immune response, and in some patients, the disease may be limited to this response,

while in others, it leads to lung involvement, progressing into pneumonia.³ The clinical manifestations of COVID-19 include fever, dry cough, fatigue, sputum production, shortness of breath, sore throat and headache. Loss of smell and taste are potential early symptoms or subclinical markers of COVID-19 infection. A preliminary study from Iran found a significant increase in new-onset anosmia in patients with COVID-19.⁴ Nasal mucociliary clearance is the primary defence mechanism of the respiratory system. The mucous membrane starts in the nose and extends to the upper and lower airways. Inhaled particles adhere to the nasal mucosa, which lines the nasal cavity in a single layer, and efficient and coordinated ciliary activity transports the mucus towards the oropharynx. In this way, mucociliary clearance

protects the respiratory system against inhaled particles and microorganisms. Ineffective ciliary activity can lead to acute or chronic infections in the upper and lower respiratory tract.⁵

The saccharin test is a simple, easy-to-perform, widely used, inexpensive test. It was first described by Andersen and is used to measure nasal mucociliary clearance (NMC) time. It is based on measuring the time until the taste of the saccharin placed 1 cm behind the anterior end of the lower concha is felt. In healthy adults, this time varies depending on the studies; however, it is 10-15 minutes on average. Values over 20 min have been reported to be prolonged NMC. It has also been reported that there is a correlation between NMC obtained by the saccharin test and tracheobronchial mucociliary clearance.⁶

METHODS

Our cross-sectional study was conducted in department of otorhinolaryngology, Sathagiri institute of medical sciences and research Centre, Bangalore from April 2021 to May 2021 for 2 month duration after obtaining institutional ethical committee approval. The study was conducted in 100 health care workers who are working in various departments of our institution and satisfying inclusion and exclusion criteria. In these 50 health care workers, with post covid status of 2 weeks, who were tested positive for SARS-CoV-2 by RT PCR, has taken as cases. 50 health care workers without SARS-CoV-2 infection taken as control group. All participants included in the study after obtaining written informed consent.

All of the health care workers included in the study were assessed by the same physician, and the mucociliary clearance assessment using saccharine test was performed by the same researcher. All participants underwent an ENT examination. The color of the nasal mucosa (pale-hyperemic), turbinate hypertrophy, septal deviation and polyps were assessed on ENT examination.

Sampling technique

Universal sampling technique (purposive sampling).

Sample size

The sample size was 100 (50 in each group).

Procedure

The saccharine test was performed on all participants using appropriate personal protective equipment to measure NMC. Oral intake was discontinued within 1 hour before the test and the patients were rested for 30 minutes. A 0.5 mm saccharin particle was then placed approximately 1 cm behind the medial surface of the inferior turbinate with the help of a Tilley's nasal forceps while the participant was seated in the upright position

and the participants were asked not to sneeze, sniff or wipe their nose throughout the test. During the test, the participant was asked to swallow at 30-second intervals and report when she/he felt the taste of saccharin. The time from the placement of saccharin in the nasal cavity to the perception of taste was evaluated as NMC time. The NMC times of all participants were calculated and compared in their own age group according to the reference values reported in the literature, and the effect of SARS-CoV-2 on NMC was analyzed.

Inclusion criteria

All health care workers between ages 20-55 years included in the study. All health care workers with post covid status of 15 days were included in the study.

Exclusion criteria

Health care workers with history of smoking. Comorbid systemic disease like HTN, DM or any chronic infection. Active focus found in nose, throat, oral cavity and history of allergy. Health care workers below 20 years and above 50 years. History of chronic upper respiratory tract infection. History of nasal surgery/ trauma/DNS. Health care workers not giving consent and pregnant women.

Statistical method

The data collected was entered in MS Excel sheet and analysis will be done by using Statistical package for social sciences (SPSS) version 20. Result was expressed in the form of descriptive and inferential statistics. The student-T test was used to compare the significance of NMC time in case and control group. In the study, a correlation analysis was carried out to determine the correlation between age, sex, covid symptoms and mucociliary clearance time. $P < 0.05$ is considered to be statistically significant.

RESULTS

Out of 100 health care workers included in our study, 45 were males and 55 were females (23 males and 27 females in non COVID group (control), 22 males and 28 females in covid group (case), p value was 0.843 (>0.05). Mean age of study group was 32.6 ± 7.632 and control group was 32.80 ± 8.473 , with a p value of 0.902 (>0.05)

NMC time was measured on an average of 2 weeks after COVID-19 infection, and the mean NMC time was 12.26 ± 2.732 minutes in study group and 9.50 ± 1.930 in control group. Although different values have been reported in the literature, the mean reference NMC time was between 10-15 minutes.⁷ Values over 20 minutes should be considered as prolonged NMC.⁸ P value was 0.112 (>0.05), so there was no statistically significant relation between NMC time and COVID-19 infection. In our study we also compared loss of taste/smell in COVID-19 patients and its significance on NMC time.

Out of 50 study group patients 26 were having loss of taste/smell. Mean NMC time observed in these 26 health care workers was 11.9 minutes.

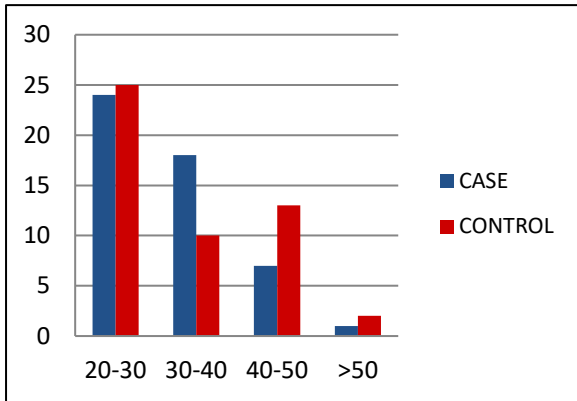


Figure 1: Age distribution.

is inexpensive, simple to do, and reproducible as given in study by Stanley et al.⁹

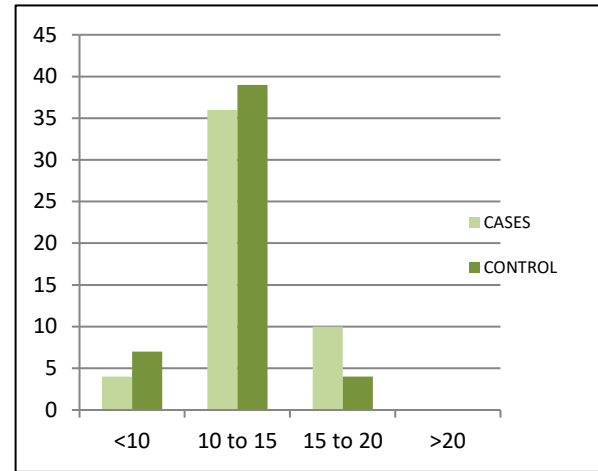


Figure 4: NMC time in case and control.

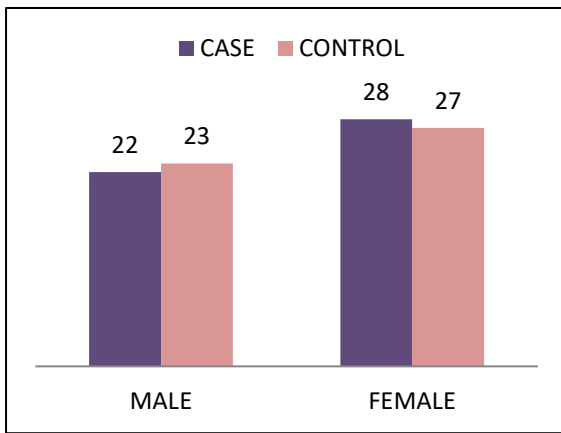


Figure 2: Sex distribution.



Figure 5: Placement of Saccharine pellet at anterior end of inferior turbinate.

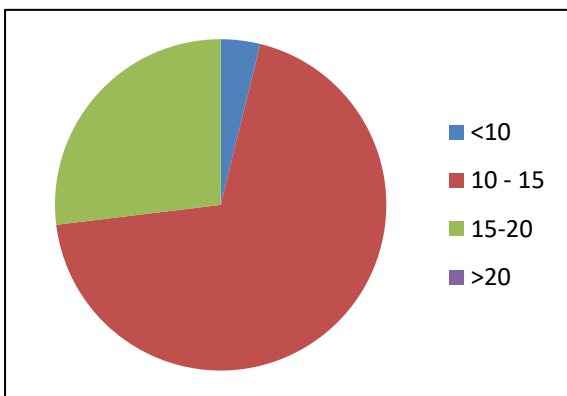


Figure 3: NMC time in cases with loss of smell/taste

DISCUSSION

Mucociliary clearance is the primary defense mechanism of the respiratory tract and protects the respiratory tract from foreign bodies such as small particles, dust, and pathogens. The saccharin test is a useful screening technique for measuring nasal mucociliary clearance as it

Nasal mucociliary clearance depends on two principal components, the properties of the cilia like beat frequency, coordination and the physiochemical qualities and quantity of the mucus. Acute upper respiratory tract infections can affect the nasal mucociliary clearance by direct damage to the cilia and change in the properties of the nasal secretions. When the normal NMC mechanisms are disrupted, this is followed by mucus stasis and secondary infections occur as a result of increased exposure of the airway to antigens. Therefore, the Preservation of mucociliary clearance during viral infections is a vital factor affecting the course of disease.

Studies reporting the frequency of upper respiratory symptoms and olfactory dysfunction in COVID-19 disease have been published in literature. In a study conducted by Mao et al out of 214 patients with the diagnosis of COVID-19 reported anosmia.^{10,11} In the study by Vaira et al., this incidence was reported to be 19.4%, it was thought that this resulting odor disorder may be directly related to olfactory cell damage. These

results have shown that the SARS-CoV-2 virus also has effects on olfactory epithelium. Though there are evidence of olfactory epithelium damage, out of 26 patients who complained of anosmia/hyposmia in our study did not show any prolongation of NMC time.

There are multiple factors affecting the nasal mucociliary clearance including smoking, old age, certain infections, irritants and allergy, our study could not establish a correlation between COVID-19 and mucociliary clearance. Though virus was detected in all the swab samples from the study group, which shows active infection of the epithelium, the saccharin test time was within the reference values.

Limitations of the study

The major limitations of study were, it was a cross sectional study. Sample size considered was small and the study was conducted only on health care workers hence it cannot be generalized.

CONCLUSION

Mucociliary clearance is an important airway defence mechanism, which may lead to a wide array of diseases including lung pathology, though few viral infections prolong the NMC duration, in our study, we did not find a statistically significant difference between the COVID and non COVID groups in terms of NMC duration. NMC was not adversely affected and there was no correlation between age, sex, COVID symptoms (loss of smell/taste) and NMC time. However, in this context there is a need for further research on this parameter in COVID-19 patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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