Letter to the Editor

Mask and COVID-19

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ABSTRACT

The author deliberates on the sudden rise of mucormycosis during the second wave of COVID-19 in India and also the increased incidence of post-COVID morbidities. The role of unhygienic use of face masks and prolonged use of respirators in changing the microclimate of the nose and its effect on the respiratory physiology have been discussed. The author has put forward some suggestions for the readers to consider.

Keywords

Immunity; Microclimate; Respiratory System; N95 Respirators; Masks; Mucormycosis; COVID-19

Epidemiology is now widely used as the science that deals with the prevalence, distribution and control of disease within the population be for a pandemic, an epidemic or for communicable diseases. Health care facilitators appreciate the value of this particular science in their applications. The extension of the epidemiological approach of Post COVID situation of 1st and 2nd waves, especially the incidents, infectivity, and post-infectivity emergence of fungal infections are to be considered for correlation.

People and the Government have learnt lessons in 1st wave: the infectivity, mobility and mortality rate and also learnt the need of vaccination (for herd immunity). The 2nd wave confirmed the epidemiological knowledge that the virus must have mutated for their survival and the virus will change its character and became difficult to control. Prevention is better than cure. Keeping this in mind, measures need to be taken and future courses of action have to be implemented in due time by the Government. It is a fact that like influenza, a viral ailment has no medical cure. Treatment is done symptomatically and based on complications, if any. Protocols have to be conceived by observation and created as per necessity. Another fact that needs consideration is progression of disease for one and half year period, especially the tendency of the virus to mutate. But strategic guidelines had not been obeyed by the society with regard to aetio-pathology, physiology and clinical observation and environmental condition for future course of action. Keeping this in mind, measures had been taken and plans of action had to be modified from time to time by the Government. With all this knowledge, 60% COVID beds for women and children, modular Hospital in sub-divisional levels for COVID treatment has been proposed by the government as a strategy to combat the 3rd wave COVID 19 control program.

Physiology of the nose and the effect of mask

The nose has a conductive function and prepares the inspired air to be sent for safe reception by the lungs within very short interval. It adjusts temperature, humidity, cleans the air of polluting substances. The natural defense systems of the body such as nasal filtration, conditioning and other protective function must be normal and intact. The prolonged use of mask for about 10 to 11 hours in a day for more than one year at a stretch might have affected a highly effective mechanism and compromised its function. Each respiratory cycle, turbulence velocity of flow, efficiency of muco-ciliary mechanism which recycle heat and moisture carried by the expiratory air are also altered. The mucous blanket and mucous membrane

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are affected by closed airway tube chamber from nose to alveoli by the cover of the mask. There should be a well-balanced advice, allowing people for prevention as well as restrictions. The emphasis has to be on health precautions for COVID related surroundings.

Fungal infection and physiology

In the second wave an important infection that has emerged due to the growing population of immunocompromised host is fungal in nature: Mucormycosis.

Fungi are eukaryotic organism comprising molds, yeasts, mushroom and similar organism. In Immuno-compromised individuals, general cellular immunity is circumvented due to diabetes, steroid administration and even in HIV patients. Then a question which naturally arises is why did this happen during the 2nd wave and not the 1st?

1. Fungal infection in nose is very common and more than 20000 people get infected every year. ENT surgeons have been very frequently treating such fungal sinusitis for long. Incidence of chronic invasive granulomatous fungal sinusitis is not quite high as the immune response limits the invasion to the superficial mucosa only with evidence of atopy.

2. Mucormycosis is fulminant and affect patients who are immunosuppressed. The pool of immune-deficient patients has not suddenly changed in its prevalence and character and treatment protocol of 1st wave and second wave have also not changed much. But there was almost no incidence of mucormycosis in 1st wave.

3. It can be said that panoramic distribution and pathophysiology were changed specially in upper nasal passage due to prolonged and unhygienic use of mask. That can only explain non immune-compromised post-COVID group getting this fungal infections.

Airflow to the Lower Respiratory Tract

The Tracheobronchial tree is not only part of anatomical continuity with nose. The entire tract from the tip of the nose to terminal bronchial is a single physiologic unit as far as conduction, cleaning and conditioning are concerned. In proper perfusion of the lungs, the physiology of airflow in and out of the pulmonary portion of the lung must be considered. Prolonged and unhygienic use of the face mask (considered as nasal irritants) may hamper the physiology of the entire respiratory tract.

a) Proper functioning the mucociliary mechanism within the nose depends upon the recycling of the heat and moisture carried by the expiratory air. Prolonged use of mask will hamper the function of lower respiratory tract physiology and closed respiratory tube losing its physiological function thus jeopardizing the immunological status of the whole respiratory tract from nose to alveoli.

b) Tight fitting masks cause inadequate ventilation and increased levels of carbon dioxide (CO_2) known as hypercapnia. As CO_2 is a known respiratory stimulant, a buildup of exhaled CO_2 between the mask and face will cause increased lung ventilation and respiratory activity. Symptoms of hypoxemia such as chest discomfort and tachypnea have also been noted by me in healthcare professionals with prolonged mask use. Exhaled CO_2 builds up between the mask and face, and increased levels of CO_2 cause confusion, impaired cognition, and disorientation. For people with COPD, face masks are, in fact, intolerable to wear as they worsen their breathlessness

c) Laryngeal complications: Bacteria, virus, dust and allergens accumulating on the mask can lead to sore throat. These particles tend to reside on the mask when you use them without washing for a long time. The tiny particles pass on to the throat, causing irritation and strain. People with weak immunity and those allergic to dust or pollen particles are more prone to this.

d) Bronchial constriction changes the depth and rate of breathing.

e) Wearing an ill-fitted face mask makes the exhaled air go into the eyes. This generates an uncomfortable feeling and an impulse to touch the eyes. If hands are contaminated chances of getting infected increases. Moreover, a fraction of carbon dioxide previously exhaled is inhaled at each respiratory cycle. This will increase breathing frequency and depth thus

increasing the amount of inhaled and exhaled air. This may worsen the burden of COVID-19 if infected people wearing masks spread more contaminated air. This may also worsen the clinical condition of infected people if the enhanced breathing pushes the viral load down into their lungs. N95 respirator and surgical facemask also causes different heart rate and subjective perception of discomfort. The physiology for these phenomena is not fully understood. One possible reason is due to the change of physical conditions around the respirators and masks. Both N95 respirator and surgical facemask cause variations of microclimates around the masks and slow down heat and substance dissipation.

f) Thermo generation impact: A hot and humid environment found in the facial region covered by masks, causes discomfort and hyperthermia. This may create a situation where the healthcare professional is unable to recognize dangers and perform manual tasks, and it also significantly affects motor skills. The moist environment and pressure from tight fitting masks also block facial ducts. This can explain the increase of acne with prolonged mask use.

Few Observations/Suggestions

1. In the 1st wave, there was hardly any fungal infection in respiratory tract and no significant post COVID mortality and further admission in hospital.
2. In the 2nd wave, there were 20000 cases of Mucormycosis in nose and post COVID respiratory complications increased during this wave.
3. Human defense against infections is mediated on several levels, any of which may breakdown and allow infections. Unhealthy and prolonged use of mask hampers the nasal environment and airway passage.
4. Humidity and temperature alteration, especially in tropical climate may break down the integrity of the respiratory system and can mediate the fungal infection to grow.
5. Mask must be used, like in some occupation health hazards but with a precaution: “should not be used continuously”. A gap or interval has to be taken for repair and returning to a healthy respiratory cycle.
6. Steam inhalation must not be taken more than one to two times specially in non-inflammatory condition.