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COVID-19: A Threat for Survival of Obese People- A Review Paper

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Abstract: ***Obesity is a condition that increases the possibility of developing a wide range of non-communicable diseases and as a serious consequence, also promotes the chances of being suffered by deadly infectious diseases. This is most clearly noticeable in the pandemic situation of global spread of the COVID-19. Obesity is considered as an access to various non-communicable diseases as well as mental-health illness and in present scenario it has been found to be a key factor in COVID-19 complications and mortality. Further, obesity has been identified as a major comorbity in patients with asthmatic disorders which also proves it as a risk factor for more serious corona virus disease. Obesity has been recognized as a disease in its own right as well as a risk factor for other health issues including significantly worsening the outcomes of COVID-19 infection.***
Keywords: *Obesity, COVID-19, Pandemic, Comorbity.*

I. INTRODUCTION

Obesity is a state with a body mass index (BMI) > 30 Kg/m^2 [i]. BMI of 40 Kg/m2 or higher is classified as severe obesity and that person is labeled as 'vulnerable' by the 'Centre for Disease Control and Prevention' (CDC)[ii]. World Health Organization and the World Obesity Federation have declared the obesity as a potential cause for worse COVID-19 outcomes[iii,iv]. The reports also clarify that the large number of COVID-19 patients that need an intensive care on hospitalization were found to be obese and overweight.

An international team of researchers pooled data from scores of peer-reviewed papers in the first analysis of its kind, published on 26 August in *Obesity Reviews*, capturing 399,000 patients reported that the persons with obesity were 113% more likely contracted SARS-CoV-2 than people of healthy weight to land in the hospital, 74% more likely to be admitted to an ICU and 48% more likely to die.[v]

This article summarizes the available scientific evidence on the role of obesity in COVID-19. Reports ad studies have been published recently that indicate that obese people are at higher risk of getting infected seriously from coronavirus[vi]. Researches, in particular, showed that obesity is a risk factor for hospitalization, requirement of intensive care and results in the development of serious consequences that ultimately lead to death as happening in the case of COVID-19 disease[vii], [viii], [ix]. An undermined composition of the gut micro biome, which regulates the host's immune system and protects against infection, is associated with obesity. Survey of reported literature also reveals that the dietary disorders mainly consumption of high levels of processed foods which in turn results in the overweight, is linked with mortality due to this deadly disease.

II. OBESE PEOPLE ARE MORE VULNERABLE TO COVID-19 WHY?

In present scenario, COVID-19 is spreading like a wildfire; morbidly obese people have greater chances of getting infected. Overweight and obesity promote the chronic inflammation, vitamin D deficiency and hinder immunity. It results in the lung compression and breathlessness which in turn is a root cause of increased susceptibility to COVID-19 infection. Human body contains fat cells namely Adipocytes with multiple receptors. One of the receptor, Angiotensin is mostly present in fatty cells. The affinity of the virus responsible for COVID-19 disease is higher towards angiotensin receptors, which results in the affect of obese people from corona virus to a higher extent. Further, obese persons already suffer from the improper working of the lungs and commonly suffer from breathing problems. In human body immunity is categorized as- **acquired immunity** and innate **immunity** which are lower in obese persons due to the deposition of fat and result in lesser capacity of fighting with any type of virus for these people.

Our blood contains White blood cells (WBC) which protect the body against infectious disease as well as foreign raiders. Diabetes is commonly found associated with obese body. A diabetic body is unable to generate enough WBCs to fight infection and get infected very easily. Simultaneously some hormones also get secreted during infections which are more in diabetic patient as compared to that in healthy body. This is also one of the reasons for these patients getting affected more by COVID-19.

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Large numbers of researches in this particular context are being carried out all around the globe. A study in France showed that the risk for needing ventilators in patients with COVID-19 was more than 7-fold higher for individuals with a BMI above 35, compared to those with a BMI less than 25.[x] Another study in New York City found people younger than 60 years of age with a BMI above 30 were significantly more likely to be admitted to care than individuals with a BMI less than 30.[xi] Additional research from New York City demonstrated that patients with obesity had significantly higher rates of admission to intensive care units or rates of death.[xii] Similarly, a study in Mexico reported that COVID-19 patients with obesity had higher rates of admissions to intensive care units, were more likely to be incubated, and had a five-fold increased risk for mortality. [xiii]

This pandemic has brought a serious risk for obese patients as if they get infected, the complication rate gets increased and their survival rate gets reduced to a large extent. According to data released by WHO, most of the people who died from the virus were obese or diabetic. There is an alarming situation for people suffering from Obesity in the entire world.

III. MECHANISM

A preliminary result of a study at a hospital in New Delhi reported that Covid-19 has been especially leading to complications in patients with obesity (or overweight) and Body Mass Index (BMI) more than 30. In the ongoing study, data of 1,000 patients infected with the virus have been collated over a period of four months. The data reveals that obesity has come out as an independent risk factor in Covid-19 cases.[xiv]

According to the medical director, Lok Nayak Hospital, most of the younger covid positive people requiring admission in hospital are overweight or obese. It is due to the fact that such people have high insulin resistance and their lung function and respiratory reserve are also compromised thus predisposing them to disease related complications.[xv]

It has also been observed that the obesity-induced fatty liver increased the risk of complications in COVID patients as such patients have high inflammatory markers, a longer cytokine storm and a potentially delayed clearance of the virus leading to increased severity and prolonged illness.

Obesity is mainly characterized by the increase in abdominal circumference which in turn causes a compression in the lung structure and results in the tethering forces between the lung parenchyma and airway. Due to this oxygen saturation at the lung bases is reduced with impaired ventilation and the person feels difficulty in breathing [xvi]. An obese person is associated with a large number of health issues such as hypertension, dyslipidaemia, type 2 diabetes (T2D) and chronic kidney or liver disease which are being reported as major risk factors for COVID-19.

Published reports from the COVID-19 pandemic experiences state that a people with obesity already takes comparatively long duration to clear the virus and simultaneously favors the emergence of new, more potent virus strain. Researchers have reported that the body mass index is correlated to the quantity of infectious virus in exhaled breath positively.[xvii]

Coronaviruses enhance T-helper 1 (Th1) cells, cytokines (IL-1, IL-6), and inflammatory chemokines (chemokine (C-C motif) ligand 2 (CCL2) protein and C-X-C motif chemokine ligand 10 (CXCL10) protein). The present scenario demands for additional policies to sustain the immune response, particularly acquired immunity so as to diminish the impact of respiratory and other infections.[xviii] [xix] [xx]

Inflamation is a consequence of the stress and interruption of many tissues integrity determined by the obesity. The enlarging adipocytes present oxidative stress and boost the discharge of NEFA in the adipose tissue leading to the activation of classical macrophages (M1) and production of IL-1β, TNF-α and IL-6. Simultaneously an adverse hormonal secretion also promotes inflammation such as low adiponectin and high leptin productions as observed in obesity.

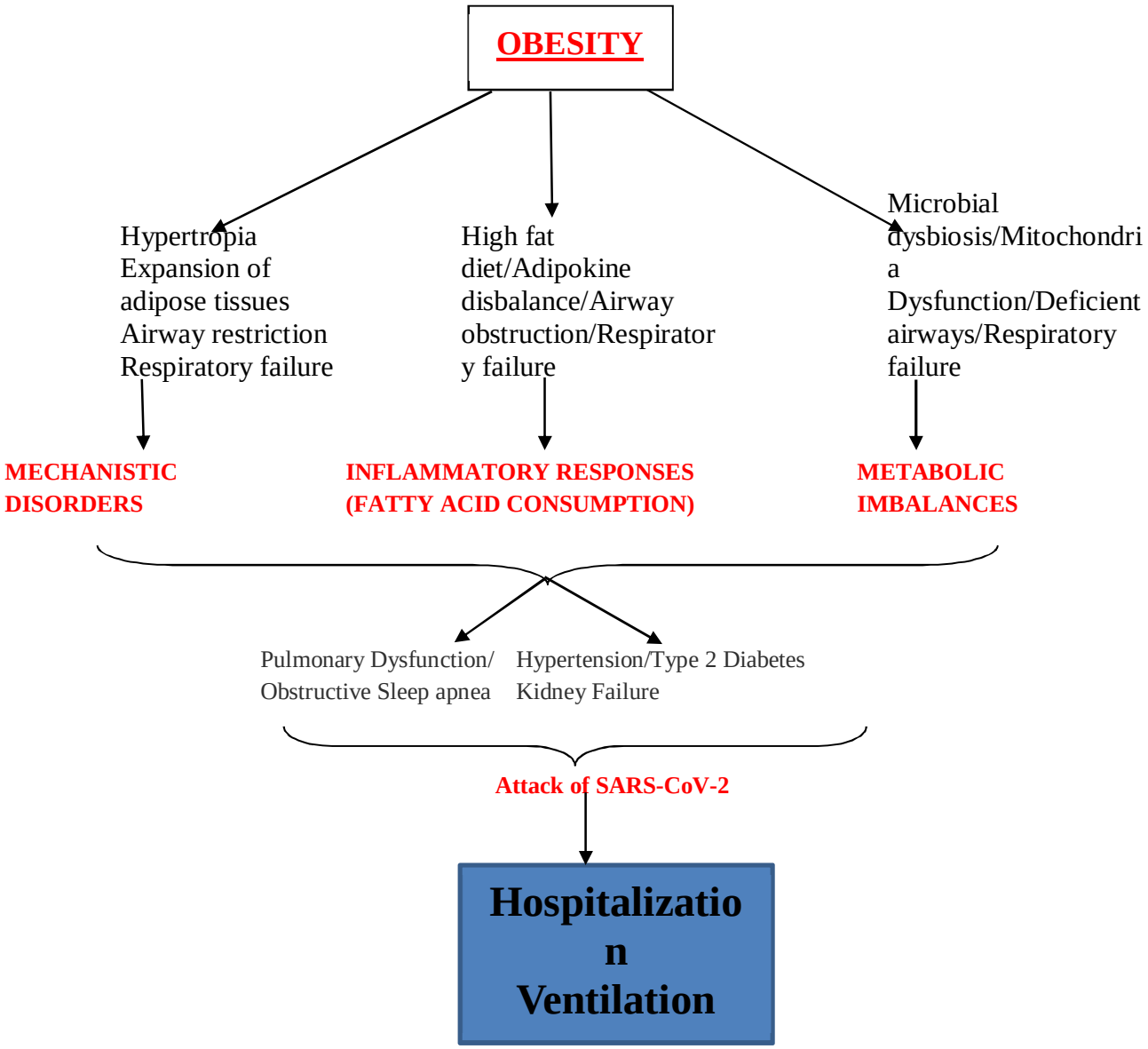
In the lymphoid tissue, lipid accumulation in the bone marrow, thymus and secondary lymphoid organs results in altering the immune tissue architecture in a very similar way as observed in ageing. In the gut, inflammation is induced by the oxidative stress which is a major cause of dysbiosis, increased gut permeability and also induces endotoxemia, signalized by an increase in lipo-polysaccharide, gut-derived plasma.

Literature studies of influenza infections in lungs proclaim the compact ability of dendritic cells (DC) to present antigens (Ag) to T cells, undermining monocyte and CD8+ T cell recruitment and reduced production of IL-2 and IL-12. Effector CD8+ T cells are not capable to kill influenza-infected cells much effectively and result in the compromised healing of pulmonary epithelial cells leading to microvascular permeability and protein leak.[xxi]

Therefore, obesity induces the inflammation that results in stimulation of leucocyte subpopulations, weakens the immune response and ultimately the risk of respiratory infection along with other severe diseases gets multiplies.

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IV. CONCLUSION

Corona virus disease 2019 (COVID-19), a deadly infectious disease caused by the novel severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), was declared a pandemic by the World Health Organization on March 11, 2020 and continues to spread across the globe.[xxii] The novel Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) has created a global pandemic with its syndrome, COVID-19. The number of people affected by COVID-19 continues to increase worldwide, and information about risk factors for severe COVID-19 and mortality is emerging almost daily.

An obese person in general has existing co-morbidity, like diabetes or cardiovascular disorder and is at a high risk of getting these complications. Precautionary measures of social distancing or self-isolation may increase stigmatization and psychological deterrents. Special attention is required targeting this vulnerable population. COVID-19 vaccination, regular physical exercise and a balanced diet as well as the home isolation and administration of prophylactic vitamin D along with an emotional support of family are strongly recommended for these people to fight against this deadly disease.

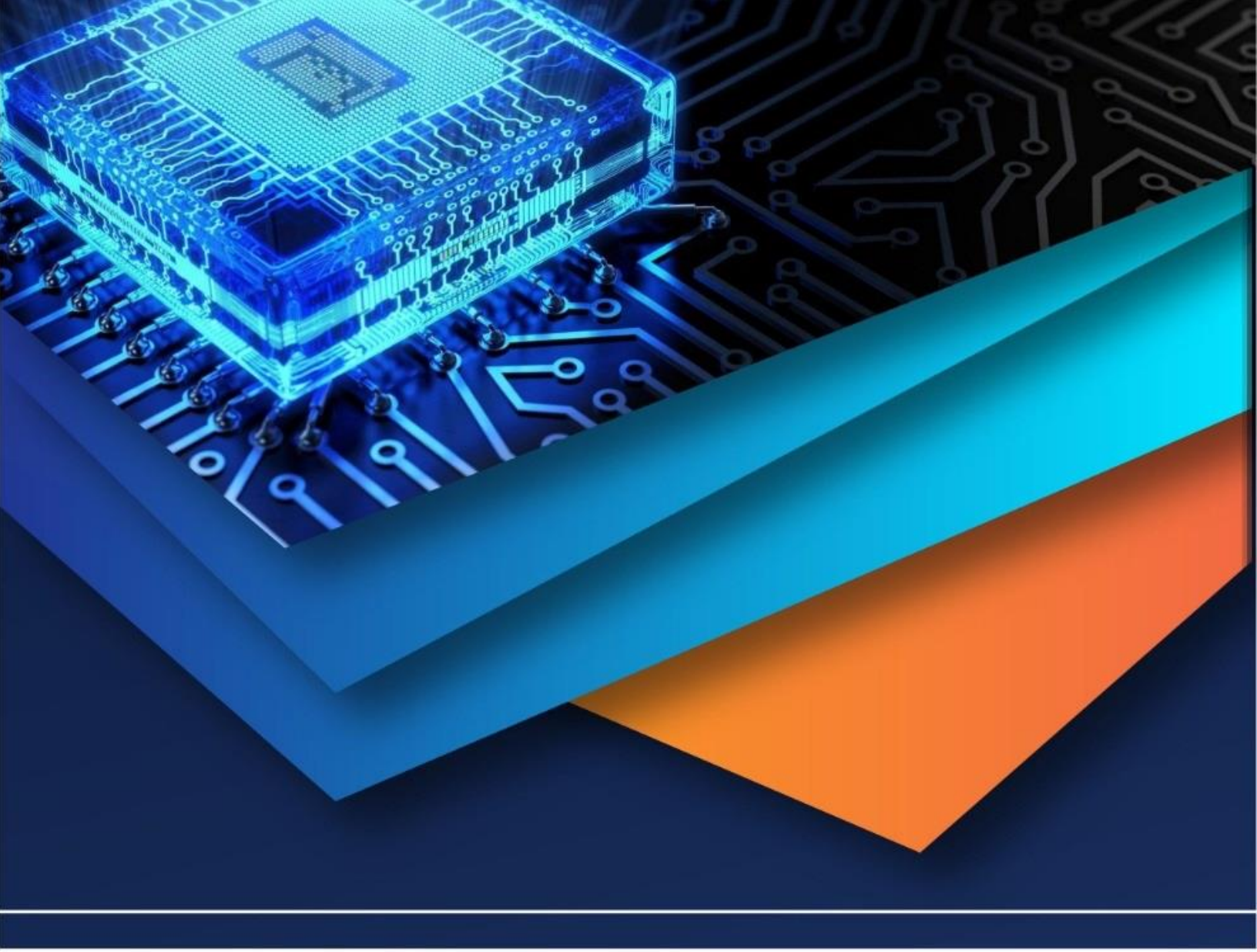
Obese and overweight patients are recommended to take care of themselves as they have the highest chances of getting affected by it. Government must ensure that people living with obesity to be included among the groups prioritized for testing and vaccination.

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