

Obesity as a Risk Factor for Severe Unfavorable Outcomes in COVID-19 Infected Adults: A Mini Review



Peter Robiel Mikhael Nashid^{1*}, Daa Marzouk Abdel Hamid^{1,2}, Maha Elgaafary², Essam Baioumy³ and Maha Magdy Wahdan²

¹Department of Family Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt

²Department of Community, Environmental, and Occupational Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt

³Department of Internal Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt

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***Corresponding author:** Peter Robiel Mikhael Nashid, Department of Family Medicine, Ain Shams university, Cairo Email: paternashid@gmail.com

Abstract

SARS-CoV-2 virus is also well known as COVID-19 and still causes a devastating effect worldwide on both health and economics. Apart from the well-known severe effects of COVID-19 virus on the respiratory system like acute respiratory distress syndrome and cytokine storm, COVID-19 is thought to cause more damage in patients with chronic disease like hypertension and diabetes mellitus. Obese individuals usually complain of obstructive sleep apnea, asthma and obesity hypoventilation syndrome added to the commonly associated diseases with obesity like hypertension and diabetes mellitus. Obesity also usually causes a pro-inflammatory state that when accompanied with the inflammatory state caused by COVID-19 is thought to cause a worse outcome.

Keywords: Obesity; Body Mass Index BMI; COVID-19; SARS-CoV-2; Outcome

Abbreviations: BMI: Body Mass Index; WHO: World Health Organization; TNF: Tumor Necrosis Factor; TLR: Toll-Like Receptor; ARDS: Acute Respiratory Distress Syndrome; DIC: Disseminated Intravascular Coagulation; ICUs: Intensive Care Units;

Introduction

As known COVID-19 first appeared in Wuhan, China in late 2019 and early 2020 and then it has spread to the entire world causing great burden on the medical and financial sectors and affecting the population from every age, race, and sex [1]. Concerning the situation in Egypt, the WHO claimed that from 3 January 2020 to 17 October 2022, there were 515,388 confirmed cases of COVID-19 and 24,797 fatalities [2]. Egypt confirmed and reported its first case of COVID-19 on February 14, 2020, and it was the first confirmed case to be reported in Africa [3]. Apart from the COVID-19 well known symptoms either pulmonary or extrapulmonary, it is thought that it affects, like H1N1, patients with chronic diseases leading to worse outcomes than healthy ones [4-8]. In the years 2015 to 2018, more than two-thirds of US individuals were overweight or obese, and the average population BMI (body mass index) was getting close to the obesity threshold of 30 kg/m² [9]. The US obesity prevalence was 41.9% in 2017 - March 2020 and that resulted that the US ranking,

as the 12th country regarding obesity prevalence [10], with an estimate of 173 billion dollars spent as a medical cost for obesity in 2019 [11]. On the other hand, The World Health Organization (WHO) places Egypt as having the highest global obesity prevalence, coming in at rank 18th [12]. The total mortality burden caused by non-communicable disease is roughly 71% [13]. Almost 39.8% of adult Egyptians with a BMI over 30 kg/m² were obese, according to the "100 million health" survey, which was carried out in Egypt in 2019 and examined 49.7 million adult Egyptians (over 18 years old). Adult females were more likely to be obese than adult males were (49.5% of Egyptian adult females were obese versus 29.5% of males) [13]. This review aims at discussing the possible effects of COVID-19 infection on obese adults.

Discussion

Obesity commonly causes the body to be in a constant low grade pro-inflammatory state. In particular, adipose tissue macrophages in obese individuals change from an anti-inflammatory to a pro-

inflammatory state, producing changes in the production and activation of key mediators of local and systemic inflammation [14], including tumor necrosis factor (TNF), interleukin (IL)-6, IL-1, toll-like receptor (TLR) 4, and nuclear factor (NF)-B, which may amplify the inflammatory state and favor certain outcomes [15]. Another important fact that there is a type of respiratory failure known as acute respiratory distress syndrome (ARDS), which could be caused by COVID-19, is characterized by an acute onset of diffuse inflammation in the lungs that causes an increase in pulmonary vascular permeability, an increase in lung weight, and the loss of aerated tissue and it is usually the result of an injury caused by an infection or a chemical [7]. There is also a brutal consequence that could accompany COVID-19 infection which is cytokine storm. This is a rapidly progressing, fatal clinical condition in which excessive immune cell activation and overproduction of inflammatory cytokines cause a variety of complex medical syndromes, including capillary leak syndrome, disseminated intravascular coagulation (DIC), ARDS, multiorgan failure and death [16].

On the other hand, obese patients commonly complain from other diseases like obstructive sleep apnea, Diabetes mellitus, hypertension, fatty liver, and ischemic heart disease [17,18], asthma, obesity hypoventilation syndrome and pulmonary hypertension [18]. Patients with extreme obesity (BMI > 40 kg/m²) may also have difficulty receiving treatment due to difficult intubation and extubation, difficulty placing a central IV-line, development of pressure ulcers, size restrictions on MRIs, and a lack of extra-large beds in medical units and intensive care units (ICUs) [17]. A study showed that obesity was sometimes associated with severe pneumonic lesions and adverse clinical outcomes [19]. But a previous meta-analysis showed a controversy, that obesity and morbid obesity are associated with lower mortality in patients with ARDS [20]. Another study found that with increased BMI more than 23 kg/m², a linear increase in risk of severe COVID-19 leading to admission to hospital and death, and a related increase in ICU admissions across the whole BMI range, which is not attributable to excess risks of related diseases [21]. Other researchers after doing a retrospective cohort study found that increased BMI in COVID-19 infected patients is associated with increased risk of ICU admission, intubation and mortality compared to those with normal BMI [7,22]. Another retrospective study suggested that COVID-19 infection works together with the coexisting comorbidities to result in worse outcomes in patients with higher BMI [4].

Conclusion

COVID-19 infection on its own has an effect that may differ from mild to severe from one patient to another. But there are lots of studies that support that when this infection is added to the effect of another chronic disease such as obesity, which already has a debilitating effect on the body and health, it is possible that

the outcomes could be worse than expected. So, when talking about severity of symptoms, speed of recovery, length of hospital stays, ICU admission, and mortality, obese patients infected with COVID-19 could be more affected than patients with normal BMI. So, it is highly recommended that individuals suffering from obesity be aware of these effects to avoid the possible means of infection.

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