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EDITORIAL

Post-Coronavirus World and Prevalence of Type 2 Diabetes

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Once the pandemic of Coronavirus disease 2019 (COVID-19) settles down, monitoring programs are needed for overweight and sedentary patients. The sedentary habits induced by the COVID-19 (quarantine and bed rest) can increase the risk of cardiovascular disease, metabolic syndrome, insulin resistance (IR), and neuromuscular disorders. IR in a long time can raise the risk for various disorders, such as type 2 diabetes, hypertension, cardiovascular disease, and cancer [1, 2]. A few days of bed rest (*e.g.*, due to COVID-19) are adequate to induce IR, muscle atrophy, fat deposition, oxidative stress, and low-grade inflammation [3].

COVID-19 leads to an imbalance in angiotensin-converting enzyme 2 (ACE2), which can aggravate glucose metabolism. Disturbance of the ACE2 pathway is directly associated with IR. In the pancreas, binding of the coronavirus to ACE2 causes injury to islet cells and induces IR [4]. A 3-year follow-up of severe acute respiratory syndrome coronavirus (SARS-CoV) patients reported that more than 50% of the cases have diabetes during hospitalization. Interestingly, these subjects had no history of steroid therapy and diabetes. Nevertheless, after 3 years of recovery from the SARS-CoV disease, about 5% of cases remained diabetic [4]. In a similar manner, COVID-19 patients will have a chance of diabetes in the future.

COVID-19 infection in some people can have life-changing effects. COVID-19 infection may lead to months, years, or even a lifetime of debilitating symptoms that significantly decrease patients' quality of life.

COVID-19 infection may increase the risk of IR and metabolic syndrome [3, 5]. Some of the COVID-19 patients experienced sedentary life or were hospitalized for at least 7 days. Moreover, some COVID-19 patients experienced pneumonia. An association between the disease and IR has been documented even after several years of lung disease, such as pneumonia [6]. Numerous factors can lead to hyperglycemia and IR in COVID-19 patients, including the use of medications

during hospitalization (lithium, exogenous cortisol, β -blockers, and vasopressors), oxidative stress, inflammation, and secretion of stress hormones. Moreover, overfeeding, inactivity, intravenous injection of antibiotic solutions, dextrose, and dialysis solutions can induce IR [3].

The patient infected with COVID-19 experiences psychological stress, depression, and anxiety. Some uninfected subjects also have high levels of stress due to work or virus infection. Under stress, the immune system cannot respond to hormonal changes, and consequently, inflammation can increase the risk of metabolic disease. Stress-induced inflammation is a main contributing factor to induce IR. Stress in COVID-19 patients can stimulate the hypothalamic-pituitary-adrenal (HPA) axis. Cortisol, catecholamines, growth hormone, and glucagon are secreted in response to physiological stress. Plasma levels of these stress hormones can increase 2-5 folds during stress, which in a short period can induce IR [7]. Furthermore, the secretion of stress hormones can elevate blood-free fatty acid (FFA) levels. Increased FFA levels can decrease insulin sensitivity and inhibit insulin signaling.

Quarantine and a short bed rest time (*e.g.*, 3-5 days) in healthy subjects can reduce insulin sensitivity. It has been documented that only 5 days of bed rest can induce IR, increase triglyceride, cholesterol, and blood pressure in healthy volunteers. Longer bed rest (about 9-day) is also associated with reduced insulin sensitivity and may develop IR in healthy subjects [3]. Therefore, monitoring programs are necessary in the post-coronavirus world.

In summary, hyperglycemia in COVID-19 patients is related to severe complications and mortality rates. Strict blood glucose control is essential during and after the treatment of COVID-19. Hence, blood glucose level monitoring is a medical necessity during the COVID-19 pandemic to prevent type 2 diabetes. In addition to glycaemic conditions, various factors, such as healthy nutrition, appropriate medicine, and regular exercise, should be considered by COVID-19 patients.

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CONFLICT OF INTEREST

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