

Endocrinological Disorders and Covid-19

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Abstract

Introduction: *The COVID-19 pandemic has created tremendous economic and psychological dynamics for all humankind, regardless of the challenges among the different population groups. People with endocrinological and metabolic disorders need delicate measures during this pandemic. COVID-19 has physiological and biological consequences that affect these people differently, as they have compromised bodies.*

Methods: *This article employed a comprehensive and multifaceted approach for effective data collection, placing a strong emphasis on integrating both qualitative and quantitative methodologies in order to thoroughly analyze and critically assess the significant impact that COVID-19 has had on individuals who are living with various endocrinological disorders, as well as those related health issues that often accompany these conditions. This dual approach ensured a more nuanced understanding of the challenges faced by this population during the pandemic.*

Findings: *We present an overview of challenges faced by people with endocrinological disorders during Covid-19, management and areas of concern.*

Key words: *endocrine system, disorder, Covid-19, impact, immunity*

Introduction

Endocrinological disorders have long been associated with immune alterations. Understanding how the endocrine axes modulate the functions of the immune system in these chronic conditions can provide insight into immune responses in the general population. During the pandemic, knowledge of how endocrinological disorders are important in the immune response was more critical. (1,2). The endocrine system is a network of glands that produce hormones regulating a variety of important functions such as growth and development, metabolism, especially the rate at which calories are burned, sexual function, reproduction, and mood. Hormones are the body's chemical signaling system (3). They serve as messengers from one part of the body to another. People with endocrine issues have to be extra careful with hygiene and compliance with modern protocols like wearing masks and social distancing (4). The purpose of the present review is to point out endocrinological issues and provide guidance concerning the management of these patients in the era of the pandemic. Data from previous pandemics were also summarized to provide a guide for clinical practice.

The Endocrine System and Its Role in the Immune Response

The endocrine system comprises a set of diverse glands that communicate via a signal cascade mediated by messenger molecules known as hormones. The hormones exert power in the processes that have to do with metabolism, tissue growth and repair, behavior, mood, or reproduction, among many others. A perturbation of the delicate balance of these messengers and their target structures could result, therefore, in a particular disease (5). Besides, the endocrine system can also influence processes outside of the direct control of classical targets, as hormones switch part of the immune response. Hormones develop their immune regulatory functions, in part, through communicating with the organs of the immune system such as the thymus and the bone marrow through information transmission via nerve cells (6). In this regard, all endocrine organs exert their influence on some immune parameters, due to different hormonal mediators, translating into different reading modes and a heterogeneous immune function regulation. These implications are varied depending on which of the different hormones mainly secreted by a particular endocrine gland are being addressed (7,8).



Glucocorticoid hormones, such as cortisol, insulin, and thyroid hormones, all produce a mild or moderate immunosuppressive effect by up or down-regulating different cellular and humoral immune functions (9). At the same time, these hormones are necessary for modulating immune system activity against infections, mainly as a compensatory mechanism to other changes. A dysregulation of the mechanisms involved in hormonal regulation of the immune response can lead to increased susceptibility to infections or an increased risk of disease progression in these adults (10). Situations of pandemic and severe acute stress caused by them offer us the unique observational circumstance to verify this fact. In the case of COVID-19, in less than two years, it has become clear that patients with diabetes, obesity, or thyroid dysfunctions are especially vulnerable to developing a serious clinical condition (11,12). This is due not only to autologous and endogenous hormonal, organic, and immune changes that all of these groups suffer but also to the fact that the virus has a high capacity for endocrine and exocrine tissues, thereby enhancing the pre-existing endocrine dysfunction. This manuscript seeks to synthesize current knowledge regarding the effects of endocrinological disorders on Covid-induced immunity, exploring potential mechanisms and clinical implications.

Materials and Methods

A comprehensive review of the existing literature was performed to investigate the relationship between endocrinological disorders and alterations in immune system function. Our primary objective was to analyze how various endocrine axes affect immune responses in chronic conditions. To collect relevant data, we systematically searched several databases, including PubMed, Scopus, and Google Scholar, for peer-reviewed articles and studies focusing on the interaction between hormone regulation and immune system responses, particularly regarding vaccine efficacy and outcomes. Additionally, we examined the implications of these findings within the context of the ongoing pandemic, highlighting the importance of understanding the influence of endocrinological disorders on immune responses.

Results

Impact of Covid-19 on Patients with Endocrinological Disorders

The COVID-19 pandemic has created tremendous economic and psychological dynamics for all humankind, regardless of the challenges among the different population groups (13). People with endocrinological and metabolic disorders



needed delicate measures during the pandemic. COVID-19 has physiological and biological consequences that affect these people differently, as they have compromised bodies. The current data shows that in several cases, management of chronic diseases poses special challenges during the COVID-19 pandemic (14,15). The majority of infected individuals do not develop serious or life-threatening complications. The presence of endocrinological disorders may predict a worse outcome of COVID-19. Special considerations include the management of diabetes in individuals who become infected, as COVID-19 may promote the development of possible future endocrine diseases. COVID-19 may unmask subclinical endocrinological disorders, which can have dramatic effects on ongoing hormone replacement in patients with specific thyroid disorders, creating a state of immune debilitation that makes the host more susceptible to the acquisition of existing viral infections, including COVID-19. L-thyroxine used for hypothyroidism could increase morbidity by itself in COVID-19 (16,17). Thyroxine excess has shown a higher COVID-positive status compared to euthyroid voluntary blood donors. This same population had increased psychological stress during the pandemic, greater anxiety, fear, and concerns about the economic consequences, followed by depressive symptoms, sleep disturbances, and suicidal thoughts. A significant percentage had no access to their physician, no access to scheduled laboratory hormone control, and no access to prescriptions.

The mortality rate in hypothyroidism was also significantly higher, and more were severely symptomatic, with a notable percentage experiencing mild symptoms (18,19). The perception of a state of hypoglycemia worsened in a significant number of the subjects, and those who were free to describe their feelings found that a large percentage were more afraid of hypoglycemia during COVID-19, with many describing this psychological distress as “terrible.” Data also shows that in type 1 diabetics, the fear of hypoglycemia worsens during the COVID-19 pandemic (20). A significant percentage said they were more afraid of hypoglycemia during COVID-19, and many described this psychological distress as “severe” or “terrible.” Analysis showed that increased stress leading to hypoglycemia in COVID-19 is significantly associated with reductions in activity level and behavior (21). The ongoing pandemic also affected their ability to attend doctor’s appointments or have bloodwork done.

Management of Endocrinological Disorders in the Context of Covid-19

Managing endocrinological disorders in general and the hormonal sequelae of COVID-19 survivors, in particular, have been highlighted as areas of concern. The COVID-19 phenotype appears to be predominantly vascular in nature. The SARS-CoV-2 virus binds with its spike protein to the angiotensin-converting



enzyme 2, which is expressed in the lungs, heart, testes, and gastrointestinal tract (22) It may be possible that because of the wide distribution of both hormonal and non-hormonal effects of viruses, endocrinologists need to be prepared for collateral effects (23).

- 1) Justification of immunosuppressive therapy: Avoiding steroid or hydroxychloroquine treatment unless it is absolutely necessary.
- 2) Management of the existing endocrine disease: Customizing the hormonal replacement strategies while keeping in mind the hypercoagulable state in COVID-19. Particular caution would be needed in thyroid cancer patients where an increase in levothyroxine therapy can be procoagulant. Subcutaneous and depot therapy can be considered in routine patients not requiring urgent hormone correction or in patients needing regular chemotherapy.
- 3) Medication management in postoperative patients: Rapidly returning physical hormone-adrenal function test requirements to the current COVID-19 discharge policy.
- 4) Investigations in suspected patients: Not to be delayed for patients with symptoms of Cushing's syndrome in the absence of typical features when home cortisol tests are available.
- 5) Monitoring of endocrine symptoms via telehealth: In the absence of a personal patient system, endocrine symptoms can be minimized by good replacement with steroids and long-acting hormone therapy.
- 6) Telemedicine in endocrinology: Clinic appointments to be systematically followed as can be translated by telephone.
- 7) Patient education: Guidance on when to seek medical advice, astute medicine use, and encouraging self-management strategies are important (24).

Central, peripheral, and secondary access for patients to attend essential medical appointments and collect biological specimens have been severely curtailed. The care team should be aware of these issues so they do not surprise patients with extra blood samples, which may increase their risk of exposure to the virus (25). It is worth pondering why we are so concerned about the hormonal effects of the virus. It is because, with the paucity of high-quality evidence of the effect of this pandemic on people with endocrine diseases, endocrinologists are keen to mitigate all possible risks to our patients, even if these are speculative. In the context of this major public health catastrophe, the whole purpose of holistic and personalized management changes is to protect the vulnerable (26).

Future Research Directions

Epidemiological, pathophysiological, and interventional studies should be undertaken to unravel the impact COVID-19 has on patients with endocrine disorders. These studies are especially needed in patients with PGL, who are most at risk. The aim of these studies should be to understand, in the long term, both the direct relationship between viral infections and endocrine glands, and indirect ones, which in complex critically ill patients manifest as TSH. Moreover, the use of drugs modulating the neuroendocrine system has to be investigated. In fact, an efficacious therapeutic plan should include treatment strategies to ameliorate the cytokine storm and, at the same time, the hormone release and decrease in release, according to their hormonal profile. Also, the efficacy of some current medications for endocrinologically affected patients, whose doses would be titrated according to hormonal status, must be tested in a specifically organized clinical trial, which could also be useful for viral infections other than coronaviruses. The coordination among multidisciplinary scientific societies was established to develop clinical guidelines aimed at enhancing research efforts. This involved the pooling of data from laboratory tests and results that were universally shared and validated within international databases (27). Such collaborative initiatives are intended to boost the capacity of ongoing and future research, thereby assisting clinicians and researchers in their advancement towards more tailored and specific therapeutic care. Additionally, this framework facilitates a coordinated antiviral therapeutic response to potential future pandemics. The implementation of precautionary yet responsible actions is crucial to ensure that future pandemics can be addressed with appropriate scientific and civic preparedness. To achieve this, comprehensive data collection during widespread challenges is imperative, allowing for subsequent re-analysis and interpretation. In the absence of data derived from standard research protocols, adherence to current treatment recommendations is essential.

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