Diabetes Mellitus after COVID-19 infection in a healthcare worker

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Abstract

Uncommon manifestations of COVID-19 have a great risk of going undiagnosed for longer time. Diabetes is reported to be a long-term consequence of SARS-CoV-2 infection. Thus, heightened awareness and timely recognition of diabetes after COVID-19 infection are important for occupational physicians treating healthcare workers with COVID-19.

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Key Clinical Message :

Uncommon manifestations of COVID-19 have a great risk of going undiagnosed for longer time. Diabetes is reported to be a long-term consequence of SARS-CoV-2 infection. Thus, heightened awareness and timely recognition of diabetes after COVID-19 infection are important for occupational physicians treating healthcare workers with COVID-19.

1 | Introduction

Coronavirus disease of 2019 (COVID-19) appears to have a high risk of occurrence in people with diabetes and an increased risk of mortality among individuals with type 1 or type 2 diabetes in comparison to individuals without this disease [1, 2], especially in cases of uncontrolled diabetes [3]. However, it is reported in the literature that diabetes might be a long-term consequence of SARS-CoV-2 infection [4-7]. Moreover, the spectrum of endocrine presentations in COVID-19 is still incomplete since there are atypical manifestations [8]. The lack of experience with COVID-19 has resulted in uncertainty in managing these complications. Uncommon manifestations of COVID-19 have a great risk of going undiagnosed for longer time. Here, we describe a case of diabetes mellitus, which occurred in a 45-year-old woman, healthcare worker (HCW), as a possible late-onset sequel of severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) infection, discovered during a consultation in the occupational medicine department.

2 | Case presentation

A 45-year-old woman, a HCW in a general surgery department of a university hospital, presented with asthenia and excessive polyuria in the occupational medicine department. She had dyslipidemia and a family history of diabetes in her mother. Nine weeks before this visit, she was diagnosed with COVID-19 by reverse transcription-polymerase chain reaction (RT-PCR) test on a nasopharyngeal swab specimen. During the SARS-CoV-2 infection, she received zinc therapy, vitamin D3, and ascorbic acid supplement. She did not develop pulmonary complications and was not hospitalized. Physical examination was normal. As additional exams for asthenia and polyuria, initial laboratory tests including blood glucose were performed. Hyperglycemia was found and the patient was diagnosed with diabetes mellitus type 2. She was referred to an endocrinology consultation for therapeutic management. She was treated with oral hypoglycemic agents and her symptoms were relieved without any complications. Biological controls were performed after the treatment of diabetes. Blood glucose and glycosylated hemoglobin levels gradually improved (Table 1). Her disease was controlled by medication and education.

3 | Discussion

Diabetes mellitus is a well-known risk factor for worse clinical outcomes in patients with COVID-19, which has also, significantly affected blood glucose control in patients with diabetes mellitus, directly by striking changes in patients' metabolism with significant elevations in blood glucose and indirectly by the impact of the pandemic on the management of blood glucose or the use of proposed treatments for the infection that also affect glucose homeostasis [9, 10]. Furthermore, people with metabolic diseases seem to be more often affected by long-COVID and experience more long-term consequences than people without diabetes [11]. Post-COVID-19 syndrome could affect patients with diabetes differentially by exacerbating signs of diabetes as asthenia [12, 13]. Also, it has been suggested that COVID-19 might be involved in developing acute diabetes mellitus in certain patients [14, 15]. A rise in new-onset diabetes was found in several studies, particularly in patients with long-COVID [16, 17]. SARS-CoV-2 infection might also lead to type 1 [18] or type 2 diabetes [17] or central diabetes insipidus [19] through complex and differing mechanisms. Glycemic parameters in patients with new-onset diabetes during the COVID-19 pandemic are otherwise more severe than in patients with new-onset diabetes before the pandemic [16, 17]. Our patient was diagnosed with type 2 diabetes after infection by SARS-Cov 2.

Increases in the number of diabetes diagnoses after acute SARS-Cov 2 infection have been reported in children and adults [8, 18]. The time to onset of diabetes after infection with SARS-Cov 2 was also variable according to the studies [14] ranging from more than 30 days in patients under 18 years of age [18], to an average of 2.9 months in patients aged under or aged of 65 years [20] and an average of 4.6 months among those with an average age of 65 [21]. A growing body of evidence suggests that beyond the first 30 days, the acute phase of the disease, people with COVID-19 could experience post-acute sequelae which can involve pulmonary and extrapulmonary organ system manifestations, including diabetes outcomes [20]. One study found that diabetes mellitus incidence remained elevated for at least 12 weeks following COVID-19 before declining [22]. Our HCW developed diabetes nine weeks after acute SARS-Cov 2 infection, which is the line with the reported duration in the literature.

Regarding the mechanisms of the onset of diabetes, they were varied. Long-term follow-up studies of COVID-19 were conducted to further define the potential association between COVID-19 and increased diabetes risk and to explain mechanisms of appearance. The mechanisms claiming the association between COVID-19 and the risk of diabetes are not completely clear [8]. The current literature proposes that SARS-CoV-2 may involve the pancreas [23] through several mechanisms such as cytolytic effects of the virus on pancreatic β-cells, activation of the hypothalamic-pituitary-adrenal and sympathoadrenal axes causing an increase in counterregulatory hormones, activation of the renin-angiotensin system resulting in unopposed deleterious actions of angiotensin II, and enhanced autoimmunity [24, 25]. In other studies, direct infection of pancreatic cells seems, on its own, unlikely to fully explain new-onset diabetes in people with COVID-19. Other potential hypotheses suggest autonomic dysfunction, hyperactivated immune response or autoimmunity, and persistent low-grade inflammation leading to insulin resistance [26-29]. However, some studies have reported risk factors for the onset of diabetes after COVID-19 infection. People older than 65 years or with cardiovascular diseases, hypertension, hyperlipidemia, or prediabetes are considered at higher risks and burdens than people without these conditions [17]. Our case had dyslipidemia and a history of diabetes in the mother. Risks and burdens of post-acute outcomes also increased according to the severity of the acute phase of COVID-19 and the intensity of care during the acute phase of the infection. They were significant among both non-hospitalized persons, the group that represents most people with COVID-19, and hospitalized patients after COVID-19 diagnosis [17]. Our patient developed a moderate form of COVID-19 which did not require hospitalization. Furthermore, it was also mentioned that diabetes could potentially be attributed to chronic physical inactivity, especially in the circumstances of the COVID-19 pandemic [30]. It was reported that the increase in chronic non-communicable diseases was due to the reduction of physical activity following restrictive measures consisting of mandated physical confinement and perimeter closures of localities [31] as those token in Tunisia during the pandemic.

In addition, a direct effect of the virus on the development of diabetes by striking increased release of cytokines and inflammatory mediators, leading to increased insulin resistance and associated hyperglycemia, has been also mentioned in the literature [32, 33]. This effect has also been reported in people with no or few diabetes onset factors. Diabetes could manifest in people at low risk and COVID-19 could likely amplify baseline risks and further accelerate the onset of the disease in people already at high risk [17]. Besides, a study of two large databases of more than 2.5 million children indicated that those with COVID-19 presented a higher risk of new diabetes than those without COVID-19 [18]. An analysis, which is not yet peer-reviewed, of 1.8 million people aged younger than 35 years also suggested an increased risk of diabetes within, but not beyond, the first 30 days after SARS-CoV-2 infection [34].

These findings confirm the interest of the post-COVID diabetes screening in all patients who had the disease regardless of the patient's age and clinical history. The observed Increase in the number of diabetes diagnoses after acute SARS-Cov2 infection highlights the importance of COVID-19 prevention strategies. Follow-up for healthcare workers in the occupational medicine department is therefore necessary after infection with the SARS-Cov 2 virus. This screening may help establish prevention strategies in healthcare workers, including anti-COVID-19 vaccination for eligible persons, chronic disease prevention and management, and monitoring for long-term consequences as signs of new diabetes following SARS-CoV-2 infection. This screening should be continued until at least one year after COVID-19 diagnosis. In fact, according to Narayan et al, people who survived the first 30 days of SARS-CoV-2 infection were at increased risk of incident diabetes at 12 months, compared with people without COVID-19 [35]. The inclusion of physical exercise as a possible prevention strategy of COVID-19 by reinforcing the immune defense, and strengthening rehabilitation after post- COVID-19 syndrome could be important also to consider [31, 36]. Factors postulated to influence long-term complications of COVID-19 should besides be measured, including the severity of infection, the viral load, and the presence of antibodies signaling auto-immune attack [35, 37]. A multidisciplinary collaboration including occupational physicians, diabetologists, and immunologists is thus necessary to ensure the early management and medical follow-up of healthcare workers diagnosed with diabetes to avoid its complications if not diagnosed at time and to better understand the mechanisms of occurrence of this pathology in post-COVID.

4 | Conclusions

We reported a case of diabetes mellitus after a COVID-19 infection in healthcare worker. Diabetes mellitus may be considered a clinical manifestation of COVID-19, in the case of new-onset polyuria and polydipsia following COVID-19 infection. Furthermore, the increased risk for diabetes after acute SARS-Cov2 infection highlights the importance of COVID-19 prevention strategies. It is now time to consider new-onset diabetes as metabolic clinical sequelae of SARS-CoV-2 infection and to screen COVID-19 patients for new-onset diabetes during acute illness and after recovery. Screening and management of dysglycemia should be an integral part of clinical guidelines for COVID-19 diagnosis and follow-up. Governments and health care systems around the world should evenly be prepared to screen and manage the glycometabolic sequelae of COVID-19. Finally, reporting these types of cases can help to better understand the possible complications of COVID-19 infection and its better management.

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H. Ben Said, M. Mersni, D. Brahim, G. Bahri : Have made substantial contributions to conception and design, the acquisition of data, analysis and interpretation of data;

N.Mechergui, I.Youssef: Been involved in drafting the manuscript and revising it critically for important intellectual content;

H. Ben Said, N.Ladhari: Given final approval of the version to be published.

I.Youssfi: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Data availability Statement: Data are available on request from the authors

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Tables:

Table 1: Controls of blood samples

Date of sampling	**Fasting blood glucose level** (mmol/L (g/L))	**Glycosylated hemoglobin level** %
02/02/2021	14.27 (2.56)	-
10/04/2021	12.35 (2.22)	10.6
07/07/2021	8.34 (1.49)	7.9
05/10/2021	7.6 (1.36)	7.5
01/04/2022	5.77 (1.03)	7.9
08/08/2022	6.9(1.25)	6.7