Original Article

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Complications caused by COVID-19 on the health of people with Diabetes Mellitus

Complicações da COVID-19 na saúde de pessoas com Diabetes Mellitus

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Abstract

Introduction: People diagnosed with diabetes mellitus are more susceptible to developing complications when affected by COVID-19, as they have an uncontrolled inflammatory response, and increased coagulation and enzymes responsible for tissue damage. **Objective:** To identify the complications caused by COVID-19 on the health of people with diabetes mellitus. **Materials and methods:** This is a quantitative, descriptive, cross-sectional study. The study was conducted in a city in southern Minas Gerais, using semi-structured interviews and data recorded in the KoBo Toolbox. **Results:** The study included 156 people who tested positive for COVID-19 and had a confirmed diagnosis of diabetes mellitus. The virus was mostly detected by antigen testing. The main complications caused by COVID-19 in people with diabetes mellitus were hematological (97.2%), followed by neurological (94.4%), vascular (93.7%), cardiac (91.7%), and respiratory (60.4%) complications. **Conclusion:** The early identification and follow-up of the disease, in addition to adequate management, are extremely important in order to achieve consistent and effective results against COVID-19 in people with diabetes mellitus.
Keywords: COVID-19; Diabetes Complications; Diabetes mellitus; SARS-CoV-2; Diabetes mellitus Type 1; Diabetes mellitus Type 2.

Resumo

Introdução: As pessoas diagnosticadas com diabetes mellitus possuem maior propensão a desenvolver complicações quando acometidas pela covid-19, visto que apresentam o quadro de resposta inflamatória não controlada, aumento da coagulação e de enzimas responsáveis por lesões teciduais. **Objetivo:** Identificar as complicações da covid-19 na saúde de pessoas com diabetes mellitus. **Materiais e método:** Pesquisa quantitativa, de caráter descritivo e corte transversal. Estudo realizado em um município no Sul de Minas Gerais, por meio de entrevista semiestruturada e registro de dados na ferramenta KoBo Toolbox. **Resultados:** Participaram do estudo 156 pessoas com testagem positiva para covid-19 e diagnóstico confirmado de diabetes mellitus. A detecção do vírus foi realizada majoritariamente por meio da busca do antígeno. As principais complicações ocasionadas pela covid-19 em pessoas com diabetes mellitus foram as hematológicas (97,2%), seguida e, também associada, das neurológicas (94,4%), vasculares (93,7%), cardíacas (91,7%) e respiratórias (60,4%). **Conclusão:** A identificação precoce, o acompanhamento da doença e o manejo adequado são extremamente importantes para se obter resultados coerentes e eficazes contra a covid-19 em pessoas com diabetes mellitus.
Palavras-chave: COVID-19; Complicações da diabetes; Diabetes mellitus; SARS-CoV-2; Diabetes mellitus tipo 1; Diabetes mellitus tipo 2.

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Introduction

People with diabetes mellitus (DM) are more susceptible to decompensation, complications, increased risk of hospitalization, and death when affected by COVID-19.[1-2] Various factors such as advanced age, a pro-inflammatory and hypercoagulable state, hyperglycemia and associated comorbidities such as hypertension, cardiovascular disease, chronic kidney disease, and obesity can increase the risk of developing complications.[3]

The complications caused by COVID-19 in people with DM warrant special attention, given that the overall prevalence of DM is 9.3% of the population, the long history of the disease, poor metabolic management, the presence of complications inherent to DM, associated comorbidities and the fact that it particularly affects the elderly.[4]

It is known that people with DM and COVID-19 are aged from 40 to 70 (53.6%) and have developed poor prognoses. A higher frequency of severe cases (31.8 to 61.9%) and higher lethality (7.8 to 81.3%) were also found when associated. In the US, in the population at the highest risk of death from COVID-19, 26.8% were diagnosed with DM, and the need for hospitalization due to complications also increased with age.[5-6]

People with DM can present clinical complications in addition to flu-like symptoms, as they are susceptible to a higher risk of severe pneumonia, uncontrolled inflammatory response, increased levels of enzymes related to tissue damage, and increased coagulation. Thus, a DM diagnosis has become an extremely important prognostic marker for the management of COVID-19, since exposure to hyperglycemia can affect innate immune responses to infection and contribute to the aggravation of cases.[7-8]

Faced with this reality, the relevance of this study in presenting the main complications associated with COVID-19 infection in people with DM stands out, given its contribution to evidence-based practice and the adequate clinical management of these people. Therefore, the present study has been developed with the aim of identifying the complications caused by COVID-19 on the health of people with DM.

Materials and Methods

This is a quantitative, descriptive, cross-sectional study carried out in a city in southern Minas Gerais from December 2020 to January 2022. The estimated city population is 80,494 people and, added to the number of inhabitants in the surrounding cities, it is responsible for providing care to approximately 425,799 people.[9-10]

The data on people with COVID-19 was obtained from the compulsory notification database of the Minas Gerais State Health Department, consisting of 1,923 first confirmed cases of SARS-CoV-2 in the city. The inclusion criteria were people aged 18 and over, with COVID-19 cases confirmed by laboratory tests, and who did not live in a long-term care institution, totaling 1459 people. The sample size was estimated at 428 participants, thus, it was a probabilistic random sample. Of the 428 participants, 156 had a self-reported diagnosis of DM. The eligibility criteria for this study were being aged 18 or over, having DM (regardless of type), having been affected by COVID-19 and living in an urban area.

A set of instruments was used to characterize sociodemographic and clinical data. Regarding clinical data, the history of self-reported pre-existing diseases, method of COVID-19 diagnosis confirmation and healthcare services used were analyzed. As for complications from COVID-19, those related to the disease, symptoms, and the search for healthcare services to treat the resulting complications were also analyzed.

The instruments were entered into tablet devices using the KoBo Toolbox data collection tool (mobile application).

The data were collected in interviews conducted by researchers who had been fully trained, during a home visit and after participants signed a Free and Informed Consent form.

The sample characterization data were analyzed using descriptive statistics (frequency and valid percentage). The remaining data were tabulated in Excel 2010 and then analyzed using the Stata software (version 13.0).

This study was approved by the Research Ethics Committee under: 34746620.6.0000.5142.

Results

The sample consisted of 156 participants, of whom 53.2% (n=83) were female and 46.8% (n=73) male, with 54.5% (n=85) in the 20-59 age group and 45.5% (n=71) in the 60 or over age group. Regarding marital status, 71.2% (n=111) had a partner and 32.7% (n=51) had 8-12 years of education.

The variables related to COVID-19 infection in people with DM are presented in Table 1.

Table 1 – Sars-CoV-2 virus detection method and complications identified in people with a previous diagnosis of diabetes mellitus. Alfenas – MG, 2022 (n=156)

Variables	n	%
Virus detection method		
Antigen testing	130	83.3
RT-PCR	26	16.7
Complications caused by COVID-19		
Hematological	140	97.2
Neurological	136	94.4
Vascular	135	93.7
Cardiac	132	91.7
Respiratory	87	60.4
Others	112	71.8
Searching for healthcare services*		
Yes	28	35.9
No	128	64.1

*The participants presented to the healthcare service for treatment related to complications caused by the SARS-CoV-2 virus infection.

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Discussion

The aim of the present study was to identify the complications caused by COVID-19 on the health of people with DM. According to a review study carried out with the aim of highlighting the sources of COVID-19 and its impact on individuals with DM, health comorbidities were characterized as a burden on the clinical picture of people affected by the virus due to the onset of complications, although DM was considered the main precursor of these changes.[11] Therefore, the evidence presented in this study is extremely important for the scientific community, helping to guide future research into preventive measures and early interventions that favor clinical management and harm reduction in these people.

In a review study aimed at showing that the COVID-19 health crisis could have been avoided or minimized in order to protect people at high risk, it was reported that the lethality of COVID-19 in people with DM was 7.3% higher than in people without comorbidities.[12] The damage caused by COVID-19 is multifactorial and may be related to high metabolic demand and low cardiac reserve, systemic inflammation, and thrombogenesis, especially when associated with a chronic disease such as DM.[13]

It is clear that the literature contains data and information that mostly relates the complications caused by COVID-19 in people with DM to glycemic changes.[12,14] People affected by COVID-19 and high levels of glycated hemoglobin and capillary glycemia were admitted more frequently to intensive care units, in addition to having a high mortality rate.[12] However, the present study found that, in addition to glycemic changes, there were other complications that are still under-reported, especially those related to people with DM.

The most frequent alterations in this study's sample were hematological, representing 97.2% of the sample. Similarly, in a review aimed at proposing a cardiovascular assessment algorithm for the early detection of complications, along with recommending protocols for the treatment of people affected by COVID-19, it was reported that the exacerbated inflammatory response caused by the virus can lead to endothelial dysfunction and increased procoagulant activity.[13] As such, the odds of thromboembolic events increase, given the hypercoagulation related to the acute inflammatory response and the cytokine storm in some people.[3]

Regarding the other alterations identified, such as neurological, vascular, cardiac, respiratory, and others, it can be noted that, due to minimal differences, they were all present in the health of the sample participants in this study. This finding allows understanding that the pathophysiological DM process, when in contact with the Sars-CoV-2 virus, triggers a considerable inflammatory process in the body, in addition to changes in coagulation, as mentioned above, and in the immune response, which systematically interferes with the health condition of the affected person.[15]

Thus, the literature highlights that the main neurological complications identified in people with DM, related to the data obtained in this study, are fatigue and cognitive dysfunction, such as difficulty in terms of concentrating and focusing, short-term memory, verbal fluency, and psychomotor coordination.[16] The most commonly reported cardiovascular and hematological diseases were pulmonary embolism, ischemic stroke, venous thromboembolism, myocardial infarction, and aneurysm.[17]

And finally, there are respiratory and pulmonary complications, which are directly related to Sars-CoV-2 infection. Due to the inflammatory state, lack of glycemic control, hypercoagulability, and the release of enzymes that cause tissue damage, it is associated with cases of severe pneumonia.[18]

As noted above, there was little demand for healthcare services by this study's participants to treat the complications caused by COVID-19 in people with DM. Similarly, a study aimed at understanding the health needs of elderly people who have suffered from long-term COVID-19 and their access to the healthcare system to meet these demands, reports that the low demand for care may be due to the difficulty in managing and understanding the multiple demands caused by the imbalance resulting from the disease, as well as being associated with home treatments proposed by the common sense of past generations. [19] Such facts can be applied to the results obtained by this study, as it presents a prevalence of older age groups, with 45.5% of the participants aged 60 or over.

It is worth noting that this study has limitations, such as the sample size, which may interfere with the inference of the results in relation to the population of interest and partial results related to the research of interest. This prompts future research that is committed to presenting data that provides more detailed information related to DM diagnosis, associated comorbidities, follow-up methods, and how patients may be affected by COVID-19 infection.

Nonetheless, this study broadens the vision and role that healthcare professionals have in the longitudinal follow-up of people with DM, with the aim of reducing damage, relieving acute symptoms, and ensuring the provision of effective and resolutive care. It is hoped that this study will contribute to evidence-based practice, with the aim of providing healthcare professionals with the necessary information. It is also hoped that it will be effective in future research aimed at establishing prevention, treatment, and rehabilitation measures that are effective in mitigating the consequences of COVID-19 in people with DM.

Conclusion

The complications caused by COVID-19 in people with DM are extremely significant for the health and social settings, as some complications are limiting and affect the person's physical, mental, and social well-being. The early diagnosis, monitoring, and adequate management of their comorbidities and complications are extremely important in order to ensure the provision of effective care that is consistent with these people's needs.

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Bibliographical references

1. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult in patients with COVID-19 in Wuhan, China: a retrospective cohort study. 2020. Available from: https://www.uptodate.com/contents/covid-19-issues-related-to-diabetes-mellitus-in-adults/abstract/1

2. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, et al. O diabetes é um fator de risco para a progressão e prognóstico da COVID-19. Diabetes Metabolism Res Rev., 2020. Available from: https://www.uptodate.com/contents/covid-19-issues-related-to-diabetes-mellitus-in-adults/abstract/2
3. Landstra CP, de Koning EJP. COVID-19 and Diabetes: Understanding the Interrelationship and Risks for a Severe Course. Front Endocrinol (Lausanne). 2021; Jun 17;12:649525.
4. American Diabetes Association. ADA. 2020. Available from: http://www.diabetes.org/?referrer=https://www.google.com.br/
5. Brito VPD, Carrijo AMM, Oliveira SVD. Associação da Diabetes mellitus com a gravidade da COVID-19 e seus potenciais fatores mediadores: uma revisão sistemática. Revista Thema, 2020; 18: 204-217. Available from: https://doi.org/10.15536/thema.V18.Especial.2020.204-217.1820
6. Muniyappa R, Gubbi S. COVID-19 pandemic, coronaviruses, and diabetes mellitus. Am J Physiol Endocrinol Metab., 2020; 318: 736-741. Available from: https://doi.org/10.1152/ajpendo.00124.2020
7. Kumar A, Arora A, Sharma P, Anikhindi SA, Bansal N, Singla V, et al. Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis. Diabetes Metab Syndr., 2020; 14(4): 535-545. Available from: https://doi:10.1016/j.dsx.2020.04.044
8. Huang I, Lim MA, Pranata R. Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia – A systematic review, meta-analysis, and meta-regression. Diabetes Metab Syndr., 2020; 14(4): 395–403. Available from: https://doi.org/10.1016/j.dsx.2020.04.018
9. Brasil. Secretaria de Estado de Saúde. SRS Alfenas. Belo Horizonte, 2020. Available from: https://www.saude.mg.gov.br/component/gmg/page/209-srs-alfenas-sesmg
10. **10**.Brasil. Instituto Brasileiro de Geografia e Estatística. Brasil/Minas Gerais/Alfenas. População estimada. 2020. Available from: https://cidades.ibge.gov.br/brasil/mg/alfenas/panorama
11. Nabi AHMN, Ebihara A, Shekhar HU. Impacts of SARS-CoV-2 on diabetes mellitus: A pre and post pandemic evaluation. World J Virol. 2023;12(3):151-171. Available from: https://www.wjgnet.com/2220-3249/full/v12/i3/151.htm
12. Barone MTU, Ngongo B, Harnik SB, Oliveira LX, Végh D, de Luca PV, et al. COVID-19 associated with diabetes and other noncommunicable diseases led to a global health crisis. Diabetes Res Clin Pract., 2021 Jan;171:108587. Available from: https://www.diabetesresearchclinicalpractice.com/article/S0168-8227(20)30844-5/fulltext
13. Costa IBSS, Bittar CS, Rizk SI, Filho AEA, Santos KAQ, Machado TIV, et al. The Heart and COVID-19: What Cardiologists Need to Know. Arq Bras Cardiol., 2020; 114(5):805-816. Available from: https://doi.org/10.36660/abc.20200279
14. Barone MTU, Harnik SB, Luca PV, Lima BLS, Wieselberg RJP, Ngongo B, et al. The impact of COVID-19 on people with diabetes in Brazil. Diabetes Res Clin Pract., 2020; 166: 108304. Available from: https://doi.org/10.1016/j.diabres.2020.108304
15. Okamoto IJS, Justino JCM, Souza JAS. Complicações da covid-19 em pacientes diabéticos: uma revisão de literatura. REASE., 2022;8(5):1730-9. Available from: https://periodicorease.pro.br/rease/article/view/5586
16. Zawilska JB, Kuczynska K. Psychiatric and neurological complications of long COVID. J. Psychiatr. Res., 2022; 156: 349-360. http://doi.org/10.1016/j.jpsychires.2022.10.045

17. Kaptein FHJ, Stals MAM, Grootenboers M, Braken SJE, Burggraaf JLI, Bussel BCT, et al. Incidence of thrombotic complications and overall survival in hospitalized patients with COVID-19 in the second and first wave. Thromb Res., 2021; 199:143-148. Available from: https://doi.org/10.1016/j.thromres.2020.12.019
18. Simão MCS, Oliveira JFC, Rodrigues EC, Oliveira FT, Araujo JMBG, Caldeira JRF, et al. Pulmonary complications in diabetic patients with covid-19 infection. BJHR., 2021; 4(2). Available from: https://doi.org/10.34119/bjhrv4n2-051
19. 1. Cavalaro J de O, Gallo AM, Derhun FM, Marques FRDM, Baccon WC, Pires GAR, et al. Aged people's health needs in the face of long covid-19 and access to health services. Texto contexto - enferm [Internet]. 2023; 32: e20230088. Available from: https://doi.org/10.1590/1980-265X-TCE-2023-0088en

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