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Review Article

SUMMARY OF THE INFLUENCING FACTORS AND PREVENTION AND CONTROL MANAGEMENT OF DIABETES UNDER COVID-19

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ABSTRACT

Diabetes is a major public health problem and seriously affects people's lives. COVID-19 (novel coronavirus pneumonia) outbreak at the end of 2019[1, 2].At present, it is still in the extension stage, so we should prepare to prevent and control COVID-19 for a long time. The population is generally susceptible to COVID-19[3], people with diabetes have a higher risk of infection and mortality[4, 5]. Many social and environmental factors, such as bad mood, unhealthy diet and lifestyle, inconvenient medical treatment, and economic impact, have become the main causes of diabetes. As the epidemic continues, various institutions have actively formulated relevant measures for the prevention and control of diabetes. This paper reviews the influencing factors and prevention and management measures of diabetes during the epidemic period for the reference of the general readers.

Key words: diabetes, COVID-19 outbreak, influencing factors, prevention and management

At present, the number of diabetes patients in China ranks first in the world. During the epidemic period, the diet, exercise, consultation, drug purchase, medical treatment and psychology of diabetes patients have been seriously affected[5], blood glucose management is severely challenged in many links[1]. In view of the current situation of diabetes prevention and control, the corresponding measures are bound to be incorporated into the national health plans to relieve the current medical pressure and reduce the global economic burden in the future[6], the current discovery of a good remote management mode also provides convenience for the diagnosis and treatment of diabetes patients in the future.

Epidemiology of diabetes mellitus:

Diabetes prevalence: According to the International Diabetes Federation Union (IDF) statistics[7]in 2021, there were about 537 million diabetics worldwide, and about 6.7 million people died from diabetes. The incidence of diabetes is increasing globally, and there are differences in terms of disease type, region and population distribution. The prevalence of diabetes in China is also gradually increasing, and there are differences among regions, among which the prevalence is the highest[8], the 2015-2017 findings showed a trend towards decreasing urban-rural differences[9-13]. Ninety percent of diabetes is type 2 diabetes, and the age of onset is getting younger. By 2030, the main population of diabetes in developed countries is aged 65 years and over, while in developing countries people are between 45 and 65 years[14]. Related studies in 2013 showed that the control rate of diabetes in Hubei Province was 34.1%, which was lower than the control rate of 49.2% in the national survey[13, 15], especially in the countryside is still at a low level. According to the World Health Organization, diabetes has become the third major threat to human health after tumors and cardiovascular and cerebrovascular diseases. For example, diabetes has become the leading cause of blindness in developed countries, affecting two-thirds of kidney dialysis and kidney transplant patients in the United States[16]. Diabetes is a disease of high consumption, not only for individuals and their families, but also for health authorities. And accelerated vascular complications and premature death, with a total diabetes-related expenditure of about $165,304 million in 2021[17]. According to estimates from 25 Latin American countries, the cost from diabetes is more than five times the direct cost of the disease[18].

Diabetes during COVID-19: Diabetic patients are prone to co-infection due to immune decline and other factors, so diabetic patients are more likely to be infected with novel coronavirus. Related studies have found that diabetes is one of the common complications in COVID-19 patients, and diabetes is more likely to lead to adverse outcomes[19]. There is also considerable evidence that diabetes is both a risk factor for novel coronavirus infection and a disease exacerbated by the infection. Some studies[20]found that during the COVID-19 period, blood glucose values in patients with type 1 diabetes improved significantly, and those in type 2 diabetes patients worsened briefly. Studies have also found significant increases in blood glucose and glycated hemoglobin in type 1 diabetes.

Factors affecting diabetes mellitus and complications:

Male gender, urbanization, aging, increased prevalence of overweight and obesity, genetic susceptibility to T2DM, sedentary lifestyle, smoking, inappropriate drinking, sleep status, marital status,

educational level, and environment were all analyzed by various regions and studies[21, 22]as an influential factor for diabetes mellitus. After the outbreak[6], Some new changes also have a certain impact on the occurrence and progression of diabetes, ① blockade and travel restrictions lead to reduced range of activity and activities, which leads to sedentary lifestyle, poor diet intake and so on[23]. ② Negative emotions: Because of the anxiety caused by the outbreak, the impact of the epidemic on people's work and economic income may aggravate the risk of poor blood sugar control. A US study suggested that finance and isolation have led to depression and anxiety in young people during the outbreak[19]. Patients are less monitored, follow-up and treated in medical institutions, and it is difficult to obtain timely support when psychological and disease-related problems occur.③ During the epidemic period, patients 'compliance with blood glucose collection decreased: Relevant survey in Tianjin showed that large-scale nucleic acid testing began on January 9, and the self-test was significantly reduced after the self-test increased, but the overall level was still lower than the level before the epidemic. The self-test rate on New Year's Eve was low, and it rebounded after the Spring Festival.④ Patients with diabetes themselves have reduced ability to resist various diseases due to reduced immune factors, and those with COVID-19 are more serious than those with COVID-19.⑤ Of course, there are also the opposite situation, for example, some areas may be relatively lack of food due to the inconvenient purchase of goods, so the material living standard decline, some people with special work nature isolation at home without a lot of interference, can get full rest, focus on their own health problems.

Diabetes complications include acute complications and chronic complications, and acute complications[24]including diabetic ketoacidosis (DKA), hypertonic hyperglycemic state (HHS), lactic acidosis , hypoglycemic coma, etc. DKA is mostly induced by insulin withdrawal or stress conditions such as infection and trauma. Lactic acidosis is common in elderly patients with severe hypoxia and renal insufficiency or those taking metformin[25]. Chronic complications of diabetes include diabetic macrovascular disease, diabetic retinopathy (DR), diabetic nephropathy (DKD), and diabetic neuropathy (DN)[25]. Diabetic macrovascular lesions take atherosclerosis as the basic pathological changes, mainly including heart, brain and lower limb vascular lesions[25, 26]. Correlation studies[27]found that age, diabetes duration, hypertension and other risk factors for chronic complications of diabetes.

Diabetes prevention and control and management strategies:

General prevention strategies:

According to the diabetes prevention and treatment guidelines[25], it is divided into three levels: primary prevention: refers to health education in the general population to nip disease in the bud. Secondary prevention: refers to the early detection and intervention of diabetes in high-risk groups, and actively prevent the occurrence of diabetes complications in diagnosed patients. Tertiary prevention: refers to delay the progression of DM complications, improve the quality of life and prolong life. COVID-19 is mainly transmitted through respiratory droplets and contact, while going out less, no parties and meals have become an important way to stop the transmission of the disease. In order to maintain good health at home during the outbreak, Professor Chen introduced two novel lifestyle interventions: embracing home exercise and

reducing ultra-processed foods.

Based on epidemic prevention and control and management strategies:

Epidemic-based Management Consensus and Guidelines: The lockdown implemented to prevent the spread of the outbreak after the outbreak has changed the management of diabetic patients, and the governments of different countries have taken various infection control measures to slow the spread of COVID-19. In March 2020, Chinese diabetes experts, together with grassroots medical service providers and public health managers, issued the Expert Suggestions on Grassroots Diabetes Management during the COVID-19 outbreak[28]. The main elements of the recommendations include basic requirements for management, workflow for health management, referral, treatment and long-term follow-up. COVID-19 also brings challenges to the management of diabetes. With the development of the epidemic, the online remote health management model has been further deepened[29]. In December 2020, led by the Expert Committee of Diabetes Science of the National Center for Telemedicine and Internet Medicine, the Consensus on Remote Management of Diabetes in China (2020 edition) was released[30]. Other countries have also published various clinical guidelines for the management of diabetic patients during the COVID-19 outbreak.

Various diabetes prevention and control and management programs during the epidemic: After the outbreak of the epidemic, measures such as hierarchical diagnosis and treatment, prescription medicine and telemedicine have been adopted in many countries to alleviate the problem of medical services for chronic diseases during the epidemic.

As the social industry to return to work and production, chronic disease demand for medical services gradually increasing, the community health service center, by optimizing the clinic process, the implementation of the emergency patients comprehensive appointment, the use of intelligent chronic disease management platform for chronic diseases, in the case of ensuring the safety of patients more policy simultaneously, accurate health management services for patients with chronic diseases[1].

The long prescription policy under the epidemic has expanded the scope of beneficiaries and ensured the drug needs of patients, which is conducive to epidemic prevention and control, but there are also problems of drug safety[31], need to further combine the implementation of telemedicine and hierarchical diagnosis and treatment.

The "Sany Care" team of Zhu Xianyi Memorial Hospital of Tianjin Medical University carried out health live broadcast through the existing sugar friends to convey health knowledge and confidence in fighting the epidemic to the sugar friends. According to the results, compared with the pre-epidemic, although the self-test rate of patients with glucosuria decreased, the overall blood glucose control level improved, with the average monthly fasting glucose dropping from 6.8 to 6.7, and the average monthly postprandial glucose decreasing from 9.0 to 8.6. Several systematic reviews[23, 32]HbA1c was significantly lower in telemedicine diabetic patients. A 57-year-old Canadian patient with type 1 diabetes with foot ulcers managed 3 consecutive wounds through a combination of on-site and telemedicine visits, supplemented with applications[33]. Using this technology as part of a new telemedicine strategy is expected to have a broad

impact on telemedicine services in the current COVID-19 and beyond[34]. But the treatment of diabetic complications, especially foot care, must be performed under safe conditions to prevent later amputation.

Diabetes and Endocrinology Consultant at Diabetes Care, Sussex Community Trust NHS Trust, continued to monitor the albumin / creatinine ratios during lockdown in some of his patients, affixed to the patient and then analyzed by a mobile phone app and the results sent to his team[35]. However, in 30 randomized controlled trials (n = 9,177), no effect of psychological intervention on diabetes-related distress or health-related quality of life was found. Five other studies found minor improvements, but the certainty of judging the evidence was very limited due to issues of research quality and / or heterogeneity.

Drug Management: Insulin is the preferred drug for hypoglycemia during outbreaks. Drugs that may cause volume failure or hypoglycemia should be avoided, the doses of oral antidiabetic drugs should be reduced, and even the oral drugs of metformin and glucose cotransporter-2 inhibitors (SGLT2i) should be stopped[36]. However, some studies believe that the withdrawal of SGLT-2i and DPP4 inhibitors are not necessary[37, 38]. Recommendations for the use of angiotensin-converting enzyme inhibitors during the COVID-19 outbreak are under review[39, 40].

Diabetes education during the outbreak: Education on how to manage diabetes was also continued during the lockdown period. On April 28 and 29, MyWay Digital Health, a company separated from the University of Dundee, held a free online course called Understanding Type 2 Diabetes, which includes information on the causes of diabetes, how to reduce the risk of potential complications, and details of screening. It also shows videos of diabetics sharing their experiences and opportunities for participants to ask questions and share their experiences in restrained chat. Currently, there is no diabetes follow-up face-to-face education, all by telephone, and only screening high-risk groups. A lot of people have no connection at all, so they need to fill this gap. Many course participants are eager to improve their diabetes control; some even want to alleviate their type II diabetes condition[41].

The Scottish Diabetes Association, a charity supporting people with diabetes, has also turned to technology. The organization manages more than 30 local groups, but since they were unable to meet during the lockdown, it has established two digital support groups: one for people with type 1 diabetes aged 16 to 25, and another for adults with type 2 diabetes. Each group conducted a four-week group-scale session to encourage discussion. The charity plans to continue to use digital support groups after the lockdown is lifted. The Scottish Diabetes Association also works with yoga and mindfulness teachers to offer online classes for people with diabetes.

Diabetes Self-management: Although the meta-analysis showed insufficient evidence to support telemedicine for glycemic control and other clinically relevant outcomes in patients with type 1 diabetes, it has the potential to significantly affect glycemic control and disease self-management in patients with type 2 diabetes[42]. At present, the main reported self-management mode is the irregular telephone medication consultation of hospitalized diabetes patients and outpatients. Doctors and patients should be aware of the impact of social distancing and isolation measures on blood glucose control, especially in patients with type 1

diabetes, to increase the frequency of blood glucose measurements[43].

Patients adhering to social isolation and other measures to prevent COVID-19 infection, especially those with comorbidities, must be aware of the hyperglycemia caused by stress and infection, and how to adapt to glucose-lowering therapy[44]. If the blood glucose control is good before the outbreak, the original treatment plan can be maintained and pay attention to monitoring the blood glucose; if the blood glucose control is not standard, they can visit the hospital or consult professional medical staff through the Internet hospital and WeChat platform; if the condition is serious, seek medical treatment in time under good protective conditions[45].

Health education and self-monitoring of blood glucose using smartphones has been shown to have significant beneficial effects, The implementation process is as follows: ① Push articles closely related to diabetes through the wechat group; ② Warm reminder in the wechat group at a fixed time every day, Including blood glucose measurement, medical advice's medication, nutritional nursing program implementation, data retention; ③ Develop 2 to 3 peer educators, Let them share their successful experience in the wechat group, Organize activities such as "food punch card", "drying plate" and "my kitchen", Exchange and comment with each other, mutual supervision, Increase individual activity in the communication group through peer education, While improving the patient's cognition, Promote patients to exchange treatment experience and experience, Improving agency for behavior change, Enhance patients' self-management execution[46].

Challenges: Remote management is the most effective, favorable and feasible management method during the epidemic, but there are also many challenges. First of all, the protection of user privacy in remote management software applications. Secondly, it is difficult to guarantee the authenticity of pictures or information sent by users in remote, which may cause medical disputes. At present, the relationship between doctors and patients is still tense, and the lack of trust between doctors and patients, which also leads to many doctors are unwilling or afraid to give guidance or advice on patients' conditions online. Third, at present, the management of diabetes patients is no longer only the business of the endocrinology department itself, and it is inseparable from multiple departments, which thus increases the difficulty of management.

Summary and outlook:

The COVID-19 epidemic has occurred and spread around the world, causing great impact and harm to people's life, production and even life[6]. Bad mood and unhealthy lifestyle caused by the epidemic bring negative effects to the prevention, control and management of diabetes. In the face of COVID-19, it also provides ideas for relevant government departments to prevent and face public health emergencies scientifically and reasonably, as well as to alleviate various problems in the process of disease control and prevention. Strategies developed through the crisis constraints of the epidemic have the potential to be new approaches for future diabetes treatment, and the COVID-19 outbreak should be used to systematically collect data on people with diabetes in order to understand future epidemics. Overall, the COVID-19 epidemic crisis should be used to establish innovative management strategies for people with diabetes. Telemedicine,

telemedicine education, and telemedicine education all have profound implications for the exchange of information across the professions, as well as for promoting research in other disciplines[47]. Looking forward, technology will play a greater role in diabetes treatment and management, particularly through engagement with smartphone and tablet cameras[48]advances in related medical applications and devices, and many events occurring in the clinical management and self-management of diabetes can be achieved through a technically supported approach.

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