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Diabetes and dementia links

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ABSTRACT

Introduction

The number of patients suffering from diabetes mellitus is growing globally. It is expected to observe 253.4 million sufferers in geriatric population in 2045. In this time, also 131.5 million of people is going to have dementia and other cognitive problems. In people aged over 65 these two diseases are concomitant quite often. What are the connections in the area of etiology and treatment?

Aim

The purpose of this study is to present links between dementia and diabetes are depicted in professional literature.

Results

Diabetes and dementia are associated on many levels. These conditions have common risk factors. Diabetes may contribute to cognitive impairment in many ways, promoting development of atherosclerosis, brain vessel damage and vascular dementia. Alzheimer disease may be promoted by hyperglycemia and hyperinsulinemia. On contrary also hypoglycaemia, often met in elderly diabetic patients has negative impact on cognitive function. Dementia seriously affects treatment of diabetes. The main problems are not satisfying adherence and diabetes self-management.

Conclusions

Prevention of diabetes and dementia risk factors can be performed simultaneously as the are common for both diseases. Enhancing physical activity, reducing saturated fats consumption, levels of cholesterol and body mass are considered to be beneficial in the context of described conditions. Furthermore, treatment of diabetes is strongly affected by cognitive dysfunction. Management of dementive diabetics requires individualization and using long-acting drugs. It is crucial to reduce risk of life-threatening hypoglycaemias and to create wide team to take care of these patients.

Keywords: Diabetes Mellitus, Dementia

INTRODUCTION

The number of patients suffering from diabetes mellitus is growing globally. In 2017, the International Diabetes Federation estimated that 326.5 million people of working age (20-64 years) had diabetes, and 122.8 million people aged 65-99 years were affected as well. The number of patients is expected to rise worldwide, to reach the level of 438.2 million diabetes cases in working age group and 253.4 million sufferers in geriatric population in 2045 [1]. Other serious condition commonly diagnosed among elderly is dementia. In 2017, 47 million people live with dementia worldwide. This number is projected to double almost every 20 years, reaching 74.7 million in 2030 and 131.5 million 2050 [2]. In people aged over 65 these two diseases are concomitant quite often. What are the connections in the area of etiology and treatment?

OBJECTIVES

The purpose of this study is to present links between dementia and diabetes are depicted in professional literature.

METHODS

Significant articles describing associations between dementia and diabetes have been analyzed.

RESULTS

Ageing of worldwide population is considered as one of the most significant components contributing to higher prevalence of diabetes, because older age is a considerable risk factor of diabetes development [1]. Vastness of elderly people suffering from diabetes have type 2

diabetes. The most common patomechanism of diabetes in this age group is insulin resistance and its insufficient secretion. Advanced age insulin resistance is associated with substantial amount of adipose tissue, low physical activity and decreased muscle mass in the organism. [3]. There is some evidence that diabetes and dementia have common risk factors of disease development. First, most obvious is advanced age. Furthermore, it is believed that low physical activity, increased consumption of saturated fats and obesity, alone and in context of hiperinsulinemia and resistance to insulin are important risk factors for Alzheimer's disease (AD). High levels of cholesterol are also mentioned as secondary risk factor of AD development. Further, the danger of both conditions is higher when a patient has apolipoprotein E epsilon-4 allele (Apo E ε4) [4].

Diabetes widely considered as risk factor for cardiovascular diseases, among them atherosclerosis [5]. Diabetes is also commonly known to be associated with cerebral atherosclerosis and correlating with it vascular dementia. Moreover, some data suggest a direct link between this metabolic disease and subcortical infarcts, causing mental functions impairment [6].

In elderly people, burdened with severe concomitant diseases, including dementia, suffering from diabetes excellent glycaemic control produce a risk of health deterioration or even death. The study by Budnitz et al. [7] showed that oral glucose-lowering pharmaceuticals with a risk of hypoglycaemia like insulin and sulfonylurea derivatives were the second most common medications that caused a need of visit in emergency department and further hospitalisations. Hypoglycaemia risk factors in this age group are renal and hepatic dysfunction, impaired counterregulatory mechanisms. Polypharmacy also makes a risk of low blood glucose level due to pharmacokinetic interactions between different drugs. Moreover, some elements of behavior of older people may influence the risk of hypoglycaemia. There is a poor compliance and patients may use higher doses of drugs than recommended. What is more, the diet may be improper and low food intake can be observed because of poor mental function. This phenomenon is well-known, the greater risk of hypoglycaemic accidents in elderly with dementia in parallel to those not suffering from it is significantly higher as described by Bruce et al. [8].

However, severe hypoglycaemia is also a risk factor for dementia and deterioration of cognitive functions [9].

Diabetes management in patients with dementia is also associated with risk of high glucose excursions. Impairment of cognitive functions in elderly is connected with poor glycemic

control [10]. Memory problems may present as forgetting to monitor glucose levels, to take medications, to eat on time and to attend follow-ups. Dysfunction of executive function manifests as problems with stopping old behaviors or starting something new, such as novel way of treatment. Patient seems to be stubborn and refuses any new therapy.

Moreover, it is suggested that there is bidirectional relationship between high blood glucose concentrations and cognitive dysfunction.

Long-term hyperglycaemia results in advanced glycosylation end-products generation. They are found in the senile plaques and have described ability to damage blood vessels walls. Thus, this compounds may contribute to development of Alzheimer's dementia. In parallel destruction of endothelium followed by microvascular disease is reported to cause neuronal ischaemia and cognitive dysfunction found in vascular dementia [11].

Additionally, hyperglycaemia is often accompanied by hyperinsulinemia. It is described as an independent factor causing impaired cognitive function and increasing the risk of Alzheimer disease [12]. In patients with Alzheimer disease insulin resistance, lower brain insulin receptors are observed. These pathological changes are believed to be associated with elevated accumulation of amyloid beta and hyperphosphorylation of tau protein [13]

What can we do?

Concise suggestions how to manage compliance problems in patients with dementia are presented by Munshi [14].

First of all, to counteract negative effects of memory loss in treatment doctors should recommend decrease of glucose self-monitoring frequency. Moreover, long-acting formulations and reduction of number of insulin injections should be implemented. Identification of cognitive problems in patients entitle general practitioner to ask for help of professional caregivers. Furthermore, some very simple strategies may be adopted: use of pillboxes and alarms, more than one phone reminder about clinical visit. When family doctor or other clinician observe dysfunction of executive function, he should remember that changes in treatment should be avoided or made gradually. Doctor may need to restrict access to insulin if patient takes too big doses of insulin due to old habits.

Additionally, author of the article present some general simplification strategies for older patients with diabetes.

If patient forget to take mealtime insulin, possible strategy may involve using basal insulin once a day to control level of fasting glucose. Then, replacement of mealtime insulin with once-daily noninsulin agents to control postprandial hyperglycemia is recommended. It is advised to use

long-acting formulation of metformin or sulfonylurea or sodium–glucose cotransporter 2 inhibitors.

Observed taking wrong doses of insulin should result in avoiding insulin pens with sliding scale. Fixed insulin dose before meals and simple two-dose scales are recommended.

Other very important issues in treatment of diabetes in elderly with dementia are chronic glycaemic goals. A report on the treatment of diabetes elderly describes desirable level of glycated hemoglobin (HbA1C) in patients with mild-to-moderate cognitive dysfunction as 8%. In individuals with severe cognitive dysfunction 8.5% level of HbA1C is recommended [15].

CONCLUSIONS

Diabetes and dementia are associated on many levels. These conditions have common risk factors. Diabetes may be a reason of cognitive impairment in many mechanisms. It promotes development of atherosclerosis, brain vessel damage and vascular dementia. Hyperglycemia and hyperinsulinemia are believed to contribute do Alzheimer's disease. On contrary also hypoglycaemia, often met in elderly diabetic patients has negative impact on cognitive function. Dementia seriously affects treatment of diabetes. The main problems are not satisfying adherence and diabetes self-management. Elderly people suffering from diabetes have difficulty taking proper insulin doses and matching them to carbohydrates intake, forgetting about taking medications is often met as well. Geriatric patients do not use a balanced diet and they commonly avoid eating meals or ingest tea and piece of bread only, resulting in greater occurrence of hypoglycemia. This is a vicious cycle of diabetes in demented patients – episodes of high glucose excursions, poor glycaemic control and experiencing severe life-threatening hypoglicaemias. Quality of life is significantly reduced. In elderly diabetic patients with dementia and other severe comorbitidies like ischemic heart disease and atherosclerosis, renal dysfunction, frailty harm of intensive glycaemic control is higher than the benefits. Thus glicaemic goals are different and levels of glycated hemoglobin are higher. This group of patients is in need of individualization of therapy. Glucose lowering drugs and intensive insulin therapy are not recommended. In the management, long-lasting basal insulin and oral drugs to control postprandial hyperglycaemia are advised to be used. People with cognitive problems may benefit from using long-acting formulation of metformin or other medicaments. Taking care of older patients with diabetes and dementia should be performed in multiple surfaces, involving besides general practitioner, diabetologist, psychiatrist, other healthcare professionals as personal caregiver, psychologist environmental assistant as well.

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