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Dementia in patients with diabetes mellitus

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Abstract---The role of diabetes mellitus in neurodegeneration has been confirmed by neuroimaging and neuropathological studies. Apart from causing schizophrenia, chronic exposure to hyperglycemia may worsen cognitive function and cause significant cognitive disorders, such as Alzheimer's and dementia. An 81-year-old woman was consulted by the Psychiatry department with fatigue and forgetfulness. She was found unconscious in her room. In the emergency room, her blood glucose level was 30 mg/dl with type 2 diabetes since 2012. She was able to pronounce her name correctly but forgot her age, said that she was at her home, the examinations were in the morning, and the name of her ex-employee who accompanied her and said that she already had breakfast, could repeat the names of 3 objects given. She was asked to repeat in 1 minute can only say 1 name of the object correctly, and cannot count the subtraction several times. The patient correctly pronounced the name of the object shown to her, but cannot fold paper, write sentences, or draw. The psychiatrist give her Avram 1x5 mg and Aricept 1x5 mg and also provided assistance, family education, and reminiscence therapy, and she had 8 units of Novorapid injection subcutaneously after a meal from the geriatrist.

Keywords---blood glucose, dementia, geriatric, type II diabetes mellitus.

Background

Diabetes Mellitus is a public health problem. According to the data, this disease is one of the primary causes of kidney diseases and blindness in people under 65 years old and amputations that are not caused by cardiovascular system-related disease. Based on the result of diagnoses made for people ≥ 15 years old, the diagnosis of diabetes increased by 2% from 2013 to 2018 (Kemenkes RI, 2018). Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia (Goyal & Jialal, 2022). A person is diagnosed with diabetes if he/she experiences hyperglycemia with fasting blood glucose greater than 125 mg/dL (Mouri & Badireddy, 2022).

Diabetes Mellitus can be classified into type I diabetes mellitus (DMT1) and type 2 diabetes mellitus (DMT2). DMT1 accounts for 5% to 10% of DM and is distinguished by an autoimmune system that destroys the insulin-producing beta cells in the pancreas. DMT1 is most commonly found in children and adolescents although it can develop at any age. DMT2 accounts for 90% of all diabetes cases. In DMT2, there is a reduced response to insulin or commonly called insulin resistance. DMT2 most often affects people over 45 years old (Goyal & Jialal, 2022). Diabetes mellitus can be classified as a systemic disease. Systemic disease is a disease that affects the whole body, not just a single organ or certain body part (focal infection) (Vorvick in Okaniawan & Agustini, 2021).

The role of diabetes in nerve degeneration has been confirmed by the neuroimaging study and neuropathology. MRI studies have shown that type 2 diabetes mellitus (DMT2) is strongly associated with brain atrophy (Danaei et al., 2006; Hirsch & Brownlee, 2005). The global brain atrophy rate in DMT2 is 3 times faster than that of normal aging. Diabetes is also associated with an increased chance of cognitive decline as determined by the Mini-Mental State Examination (MMSE) score (Saedi et al., 2016). Chronic exposure to hyperglycemia can worsen cognitive function because apart from causing schizophrenia, it can also cause cognitive decline diseases such as Alzheimer's and dementia, (Lee et al., 2018). Current data revealed that both types of diabetes mellitus are strongly associated with cognitive function decline (Moheet et al., 2015).

Cognitive function is the ability to include the capacity for attention, registration, memory, calculation, recall, language, consideration, writing, reading, and visuospatial (Tsalissavrina et al., 2018). DMT2 increases the long-term risk of dementia almost 2-fold (Biessels et al., 2014). Dementia is very common in the elderly and is an important part of an age-related disability. Since the proportion of people aged 65 years is expected to increase above 20% by 2050, the incidence of dementia is predicted to increase dramatically. The aging brain causes pathological changes that are caused by several risk factors. These factors may change the clinical threshold of dementia in an individual (Verdile et al., 2015). Because the decline in cognitive function, especially in the elderly due to diabetes mellitus, is a common case among all ages in Indonesia and the world, it is important to review the etiology, risk factors, pathophysiology, specific effects of diabetes mellitus on dementia patients, and the management (Matthews & Denning, 2002; Prince et al., 2013).

Case Report

An 81-year-old female was consulted by the psychiatric department with complaints of fatigue and forgetfulness. The patient was interviewed in a supine position on the bed, wearing a floral dress and a hospital blanket. The patient had an intravenous line in her right hand and her white hair was neatly combed. Her skin was white and there were small red rashes on both hands. The patient was calm and cooperative during the interview, but sometimes do not answer according to the questions asked by the examiner. The patient speaks spontaneously using occasional Balinese and Indonesian at a moderate speed and a low volume.

The patient could pronounce her name correctly, forgot her age, said that she was currently at home, correctly said the time for the examination was in the morning, and knew the former employee who accompanied her. The patient said that she already had breakfast, but had forgotten the menu. She did not know the reason she was brought to the hospital and said that she was forced by her children. According to the patient, it was due to her blood sugar problem. When asked if there was anything else that had brought her to the hospital, the patient said she did not know.

The patient complained of fatigue and it made her feel uncomfortable. She could sleep well last night and that she felt refreshed this morning after being able to sleep. She wanted to go home as soon as possible because there was no one to clean her house. The patient could immediately recall the name of 3 objects mentioned, however, after 1 minute she was only able to mention 1 object. She was not able to calculate subtraction up to several times. The patient could mention the name of the objects shown to her, but could not fold a piece of paper, write a sentence, or draw. She denied hearing voices in the ears or seeing shadows. The patient then said she was tired of answering questions and wanted to sleep.

The patient said that she cleaned her house every day. However, when she was healthy she worked all sorts of jobs, doing anything as long as it was halal, such as being a house painter. The patient also said that all of her children were busy and the patient was often left at home alone lately so sometimes the patient forgot to eat. The patient knew that she needs to inject insulin regularly, but did not like to be prevented from eating the foods she likes, especially sweet foods.

Based on the hetero-anamnesis from the patient's grandchildren, the patient was brought to the hospital by her family because of weakness and they suspected a stroke. The patient was found unconscious in her bedroom. The examination in the emergency room revealed a blood sugar level of 30 mg/dl. The patient is said to have been left alone at home because her family were busy working. The patient cleans the house every day, and when she was young, the patient used to do all sorts of jobs, such as painting other people's houses. The patient has 3 children and 5 grandchildren, but currently only lives with her eldest son and the currently attending grandchild.

A patient is a person who can always find something to do, even when she is at home. The patient always cleans her house every day and does not want help, sometimes the patient delays his meal time while cleaning the house. Before she was ill, the patient was a person who rarely spoke, only spoke as needed, and was not very close to her grandchild.

The currently attending grandchild does not know much about the patient and currently is just waiting at the hospital from night to morning. The patient was said to only occasionally leave the house to socialize, especially since the patient began to forget frequently. The patient was advised by her family to stay at home. The patient is very quiet person and obedient. The patient is only busy in the house and the environment around the house. Her husband had passed away a long time, thus she only relied on her children for her daily needs. The patient was still allowed to participate in religious activities at the local *Banjar*. The patient neither smokes nor drinks coffee.

The patient has had diabetes mellitus since 2012 and regularly went to the internal medicine polyclinic. The patient had no history of seizures or head trauma. The patient was said to have been to a psychiatrist for the past 6 months because of her forgetfulness and is still taking her medication to this day with a medication history of Avram 1 x 5 mg and Aricept 1 x 5 mg.

The patient married at the age of 18 years old and currently lives alone in the house with her eldest child. Her husband passed away 10 years ago. The patient has never been involved in any legal issue. She now lives with her eldest child and is said to frequently forget, thus she is not allowed to go outside her house out of concern that she would get lost. The patient is a quiet person and rarely speaks, now she always tells stories about her youth and always repeats the same stories.

The physical examination reveals normal vital signs and the general examination reveals opacities on the right ocular lens. The psychiatric status reveals the face is according to the illness, adequate verbal and visual contact. The patient has fluctuating consciousness with disturbed orientation. Dysphoric and congruent mood and affect. In the aspect of thought process, the form of thought is logic-realistic, the stream of thought is coherent, and the content of thought is a preoccupation with going home. There was no hallucination or illusion. There was also no hypobulia or raptus, but the patient had late-type insomnia (Yoon et al., 2006).

Laboratory examinations such as complete blood count, renal function test (BUN/SC), electrolyte (Na and K), and coagulation status (PT, APTT) were conducted. The complete blood count and renal function test (BUN/SC) were within normal limits. There was slight hypokalemia (K 3.24 mmol/L; the normal range of 3.5 – 5.1 mmol/L) in the electrolyte examination with a normal sodium level.

The patient went through several psychometry examinations such as Abbreviated Mental Test (AMT) with a score of 5 (moderate cognitive disorder), Barthel Activity Daily Living (ADL) with a score of 18 (mild dependency), Geriatric Depression Scale (Yesavage) with a score of 2 (not depressed), Global Deterioration Scale (GDS) with a score of stage 4 (mild dementia), and Mini-Mental State Examination (MMSE) with a score of 8.

The diagnosis according to PPDGJ III was Axis I: Alzheimer's Dementia (F00), Axis II: Anankastic personality trait, the defense mechanism of repression and sublimation, Axis III: hypoglycemia due to suspected low intake, controlled hypertension, hypoalbuminemia, Axis IV: problem with the disease, Axis V: current GAF of 30-21 and one last year GAF of 60-51. Therapy from the psychiatric department was Avram 1 x 5 mg and Aricept 1 x 5 mg, providing assistance and education for the family, and reminiscence therapy. The patient was also given a subcutaneous injection of Novorapid 8 units after each main meal from the Geriatric department (Marc et al., 2008; Alexopoulos et al., 2003).

Discussion

An 81-year-old widow was consulted by the psychiatric department due to fatigue and forgetfulness. The patient was able to pronounce her name correctly but forgot her age. The patient also correctly said that she was in her home, the examinations were performed in the morning, and the name of her ex-employee who accompanied her. The patient said that she already had breakfast, but forgot what kind of breakfast menu she had. When asked why she was in the hospital, she said that she did not know why she was brought to the hospital and she thought that she was forced to go to the hospital by her son due to her diabetes. The patient felt fatigued and uncomfortable. The patient could repeat the names of 3 objects given. However, after the patient is asked to repeat in 1 minute, the patient can only say 1 name of the object correctly. The patient cannot count the subtraction several times. The patient correctly pronounces the name of the object shown to her, but cannot fold paper, write sentences, or draw. The patient denied hearing any auditory illusions or seeing any shadowy illusions (Saraswati et al., 2021). After that, the patient said she was tired of answering questions and wanted to sleep. Therefore, the psychiatric mental state reveals that the patient felt uncomfortable, and had fluctuating consciousness, dysphoric congruent mood and affect, a logic-realistic form of thought, a coherent stream of thought, and preoccupation with going home. The patient also had late-type insomnia (Bellamy et al., 2009; Holman et al., 2020).

Based on these findings, this patient had clinically significant behavioral and psychological symptoms that caused distress and disability in daily life indicating that the patient had a mental disorder. The **axis I** diagnosis in this patient according to the PPDGJ III was **Alzheimer's Dementia (F00)**.

It was said that the patient was neat, tidy, and disciplined before she was sick. She is always busy with activities. When doing household chores, she did it by herself, did not want any help, and even ate a late lunch to finish her job sometimes. It was said that the patient rarely speaks and only speaks when need to. She was also not very close to their grandchildren. If she had problems, she tried to divert them to positive activities (such as cooking), thus we conclude that this patient had an **anankastic personality disorder with a defence mechanism of repression and sublimation in axis II**.

The **axis III** diagnosis found in this patient was hypoglycemia due to low intake, controlled hypertension, and hypoalbuminemia. The **axis IV** in this patient was a problem with her illness. In **axis V**, the current Global Assessment of Functioning (GAF) Scale was 30-21 indicating a severe disability in communication and judgment thus the patient is unable to function in all areas. The GAF last year was 60-51 indicating moderate symptoms and moderate disabilities (Lyketsos et al., 2011).

Conclusion

Diabetes mellitus is a systemic disease that attacks several organs. This disease plays a role in the cognitive function decline of the geriatric population. Several degenerative diseases become the aetiology of cognitive function decline and memory impairment, such as Alzheimer's disease. The risk factors of cognitive function decline in diabetes are recurrent hypoglycemic episodes, microvascular (such as diabetic retinopathy) and macrovascular (such as myocardium infarction or stroke) complications, insulin resistance, inflammation, and depression. Diabetes may affect cognitive function through vascular disorders in brain blood vessels. Uncontrolled blood glucose will cause a toxic effect on the brain. The presence of oxidative stress and the accumulation of advanced glycation and products (AGEs) have the potential to damage brain tissue in the hippocampus. Mitochondrial dysfunction is one of the factors that can cause Alzheimer's due to obesity and diabetes.

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