



The Relationship between Clock Drawing Test and Current Blood Glucose Level (GDS) in the Elderly at the Sentani Jayapura Nursing Home

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ABSTRACT

This study aims to determine the relationship between Clock Drawing Test and Glucose Levels in the Elderly at Sentani Nursing Home, Jayapura Regency. The study used a cross-sectional quantitative design with a total of 30 respondents using the Purposive sampling technique. Of the 30 respondents examined, all elderly people who experienced impairment in CDT (100%) had blood glucose levels above 200 mg/dL. In contrast, most respondents with normal CDT (90.5%) had glucose levels in the normal range. Chi-square analysis showed a value of $p=0.00$, which confirmed that the relationship between current blood glucose levels and CDT results was significant. Based on these results, it is expected to be a reference for preventive measures and treatment to prevent further strokes and disabilities.

INTRODUCTION

Stroke is the second leading cause of death and the third leading cause of disability worldwide (Katan & Luft, 2018). The main problem of stroke is related to the presence of a chronic phase. In collective perception as well as in clinical trials, disability after stroke is mainly intended as a physical disability, as well as the presence of cognitive impairment. More than half of diabetic patients experience post-stroke cognitive impairment (PSCI). In two-thirds of cases, PSCI corresponds to mild cognitive impairment, one-third to dementia (Barbay et al., 2019) and significantly impacts the quality of life of stroke survivors (Park et al., 2013). PSCI is a clinical entity that covers all types of cognitive decline after an index stroke; It can happen immediately or in the first months after a stroke. In some cases, the severity of PSCI can worsen over time (Hu & Chen, 2017), it can be due to an underlying degenerative or micro-vascular pathology (Cova et al., 2022).

Cognitive impairment can be used as an indicator of problems in the central nervous system in a person, both caused by the residual symptoms of stroke and the initial symptoms of vascular disorders in the central nervous system area. The age group that often experiences cognitive impairment is the elderly (elderly) due to degenerative mechanisms and due to diseases such as diabetes mellitus (Ettcheto et al., 2019; Nguyen et al., 2017).

Currently, the elderly population (> 60 years old) in Indonesia continues to increase in number, even in 2005-2010 it is estimated to equal the number of children under five, which is around 8.5% of the total population or around 19 million people. This condition is a challenge to maintain the health and independence of the elderly so that they do not become a burden on themselves, their families and the community. Of that number, about 15% of them have dementia or senility, in addition to other degenerative diseases such as stroke, Alzheimer's, cancer, heart, rheumatism, osteoporosis, cataracts (Ministry of Health of the Republic of Indonesia, 2017; Kusnandar, 2022; Trisfayeti & Idris, 2023).

In developing countries, life expectancy is around 10 years or more below the average life expectancy of the world's population. A longer life expectancy will lead to changes that occur in the structures and systems of the world society. Various problems experienced by the elderly such as the availability of potential labor, facilities for them, and medical and psychological problems that are often experienced (e.g., depression, dementia, heart disease, high blood pressure). Early detection of cognitive impairment can be done with a simple technique called the Clock Drawing Test. The results of this finding will be associated with risk factors for cognitive impairment in elderly patients, namely high blood sugar levels.

In Papua, there is not much data and research that focuses on the elderly and there is no data on cognitive impairment occurring in the elderly in Papua, especially Jayapura Regency as a sign or early symptom of stroke and dementia. So that elderly patients are often taken to the hospital because of sudden strokes. Based on this data, the researcher wanted to explore and analyze the results of the examination to find out the relationship between the results of the Clock Drawing Test and Blood Sugar levels (GDS) in the elderly at the Sentani Nursing Home.

THEORETICAL REVIEW

Dementia Post Stroke

Dementia is a syndrome of cognitive and functional decline, usually occurring later in life as a result of neurodegenerative and cerebrovascular processes (Killin, 2016). Dementia is a degenerative disease that often affects people over 60 years old. Dementia occurs due to damage to brain cells where the nervous system can no longer carry information into the brain, thus making a decline in memory, skills progressively, emotional disturbances, and behavioral changes, people with dementia often show daily behavioral disorders (Pieter and Janiwarti, 2011).

Dementia is a condition in which the loss of intellectual abilities hinders social relationships and function in daily life. Dementia is not part of the normal aging process and is not something that will definitely happen in future life, dementia can also be caused by a variety of brain disorders. Almost 55% of people with dementia are caused by Alzheimer's, 25-35% by stroke and 10-15% by other causes, many dementias are treated even though very few of them are curable (Asrori & Putri, 2014).

Alzheimer's affects women more often because female hormones enter menopause faster than men with andropause periods. The biggest risk factor for dementia is old age, and gender has no direct relationship with the disease. Vascular dementia is the 2nd most common type of dementia after Alzheimer's dementia, with the incidence rate of vascular dementia not much different from the incidence rate of Alzheimer's dementia. Jellinger et al. (2002) stated that the incidence rate of vascular dementia is about 47% of the overall dementia population (Alzheimer's dementia 48% and dementia due to other causes 5%).

With age, it seems that the risk factors for developing dementia will also increase. There are various instruments that can be used to conduct screening, but usually a trained expert is needed to administer it (Hartati & Widayanti, 2010).

Signs and Symptoms of Dementia

There are several signs and symptoms experienced in Dementia, including:

1) Memory loss

The first sign experienced by the elderly who suffer from dementia is forgetting information that has just been obtained or learned, it is a common thing practiced by the elderly who suffer from dementia such as forgetting the directions given, names or phone numbers, and people with dementia will often forget objects and do not remember them.

2) Difficulty in performing work routines.

Elderly people suffering from Dementia will often have difficulty completing daily work routines. Elderly people who suffer from Dementia, especially Alzheimer's Disease, may not understand the steps of preparing daily activities such as preparing food, using household appliances and doing hobbies.

3) Language problems with Elderly people with Dementia will have difficulty in managing the right words, uttering unusual words and often making sentences that are difficult for others to understand

Clock Drawing Test

The Clock Drawing Test (CDT) is a screening instrument that is useful for assessing the evolution of cognitive decline (Hartati & Widayanti, 2010). How to do the test:

1. The patient is asked to draw a circle
2. Placing the numbers on top of the circle as if it were the face of the clock
3. Draw a clock hand that shows a specific time
4. Test results
5. A negative result for dementia is indicated by a score of 1 or 2, or a score of 3
6. Normal results are shown if all numbers are in the correct order and position, and the hour hand shows the requested time clearly.

The inability to properly space numbers on the clock can be attributed to visuospatial disorders, negligence, or planning deficits (Daly et al., 2022; Palsetia et al., 2018).

Cognitive function disorders can be caused by various factors, one of which is due to vascular disorders in Diabetes Mellitus patients. High and chronic glucose levels in the blood lead to decreased vascular permeability and lead to atherosclerosis. When atherosclerosis occurs and blockage of the cerebral arteries, symptoms of ischemic stroke can occur. Therefore, high sugar levels can be associated with dementia and other cognitive disorders.

Current Blood Sugar Level (GDS)

Blood glucose is the level of glucose in the blood whose concentration is tightly regulated by the body. Glucose flowing in the blood is the main source of energy for the body's cells. Generally, blood glucose levels remain in the range of 70-150 mg/dL, there is an increase in blood glucose levels after meals and is generally at its lowest level in the morning before consuming food. Increased blood glucose levels after eating or drinking will spur the pancreas to produce insulin which prevents further increases in blood glucose levels and results in blood glucose levels slowly decreasing (Selano et al., 2020; Suparyanto and Rosad (2015, 2020).

According to the Ministry of Health of the Republic of Indonesia (2020), blood glucose level checks can be divided into three types, namely:

a. Fasting blood glucose levels

The fasting blood glucose level check is that the patient does not get additional calories for at least 8 hours (Purnamasari, 2014). Patients usually fast from the night before the examination. Drinking water without glucose is still allowed (PERKENI, 2021). Fasting blood glucose levels in patients with diabetes mellitus are said to be controlled in the range of 80-130 mg/dL (American Diabetes Association, 2021)

b. Blood glucose level 2 hours post prandial

Blood glucose levels were checked 2 hours post prandial was carried out two hours after consuming high-carbohydrate foods or drinking 75 grams of glucose. Test numbers above 130 mg/dL indicate diabetes.

- c. Blood glucose levels during
Checking blood glucose levels at a time or randomly is the result of a momentary examination of a day without paying attention to the last meal time (Purnamasari, 2014). Blood glucose levels in patients with diabetes mellitus are said to be controlled in the range (Suparyanto and Rosad (2015, 2020) (Szendroedi et al., 2016)
- d. Clock Drawing Test Examination Technique
The Clock Drawing Test (CDT) is a simple test to assess cognitive function, specifically visual-spatial abilities, planning, and executive functioning. The examination involves the patient drawing a clock and indicating a specific time (Daly et al., 2022; Palsetia et al., 2018; Sari & Wulansari, 2015). Here are the steps for the CDT examination:
 1. Set up the tools: Prepare a blank piece of paper or paper with a drawing of a circle, pencil, and clear instructions.
 2. Instructions: Give the patient clear instructions to draw a clock and indicate a specific time (e.g., 11:10 a.m.).
 3. Pay attention to the process: Record the patient's process while drawing, including how they started, how they placed the numbers, and how they showed the hands clockwise.
 4. Analysis of results: Once the patient is done, analyze the results by looking at several aspects:
 - Number placement: Are the numbers correctly placed in the appropriate position?
 - Hour hands: Does the hand show the exact time (11:10)?
 - Spatial ability: Does the clock drawn look symmetrical and well-structured?
 - Concentration: Is the patient focused and not distracted while drawing?
 - Executive function: Can the patient follow instructions and plan steps to complete the task?
 5. Scoring:
Several scores are used to assess CDT, including simple scoring (e.g., 0-4) or more complex scoring that considers different aspects such as the number of errors and difficulty.

METHODOLOGY

Types of Research

This type of research is a quantitative research with an analytical observational design with a cross sectional approach. The analysis test used univariate and bivariate tests with chi square. The measurement tool used in this study is secondary data collection through medical records and assessment using questionnaires.

Research Time and Location

Time : The research was carried out in April 2025 – August 2025

Location : Sentani Nursing Home

Population and Research Sample

Target Population

The target population of this research is all elderly people in the Sentani Nursing Home, whose exact number is not yet known because there can still be an increase in the number of elderly until the time of the study.

Sample

The sample is all elderly who have done the Clock Drawing Test and Blood Glucose Check (GDS). The sampling technique used is purposive sampling with a minimum sample number of 50 people (because the population is not yet known, so it uses $n > 50$)

Eligibility Criteria

Inclusion Criteria

1. All Elderly at Sentani Nursing Home who are willing to undergo an examination
2. All Elderly Who Have Blood Sugar Levels Checked During (GDS)
3. Exclusion Criteria
4. Elderly who are uncooperative and cannot be examined by the Clock
5. Drawing Test and Blood Glucose examination during
6. Elderly are not willing to fill out informed consent

Research Procedure

Data collection based on primary data by:

1. Respondents were given education and explanation about the purpose of the examination and the method of examination
2. Willing respondents will be directed to sign an Informed consent form
3. After signing the informed consent, the respondents will be welcome to sit in a comfortable shady room, while waiting for the officer to record their identity, age, gender, work history, habit history and past disease history.
4. After filling in the identity, respondents were examined by the GDS and Clock Drawing test to determine blood glucose levels and cognitive function.
5. The results of the examination will then be recorded, recorded in excel, and coding, and analysis tests carried out.

Data Analysis

Statistical analysis aims to describe the characteristics of the subject and the overall research variables. The data was tested with the Kolmogorov Smirnov normality test because the number of respondents was 30 people. The significance value of p is determined to be 0.05. The results of descriptive statistical analysis are presented in a single distribution table.

Bivariate analysis uses the Spearman Test correlational test. The entire stage of data analysis was done using statistical software The Statistical Package for the Social Sciences version 24 (SPSS v24)

RESEARCH RESULTS

This research was conducted at the Tresna Werdha Sentani Nursing Home, Jayapura Regency. Respondents in this study consisted of 30 people aged > 50 years. Respondents were given education about the symptoms of stroke and symptoms of cognitive decline. Next, respondents were asked to draw a wall clock circle and then be evaluated for the Clock Drawing Test. The results of the Examination are presented in the following data:

Table 1. Distribution of GDS Laboratory Examination Results by Gender

Gender	n (%)	Hyperglycemi
Man	9 (30%)	2 (50%)
Woman	21 (70%)	2 (50%)
Total	30 (100%)	4 (100%)

Source: primary data 2025

Based on the data in table 3.1, the results of blood tests showed that out of a total of 30 elderly people, 9 (30%) were elderly with male sex and 21 women (70%) were women. Based on gender distribution, the incidence of Hyperglycemia (blood glucose level at >200 g/dL) in the elderly was obtained by a total of 4 people out of 30 respondents, which was distributed proportionally between men and women, namely 2 people (50%) in men and 2 people (50%) in women.

The results of the examination also show the distribution of the incidence of Non-Communicable Diseases (NCDs) based on age groups in accordance with the Age classification according to the Ministry of Health of the Republic of Indonesia as listed in table 2 as follows:

Tabel 2. Distribution of Laboratory Results by Age

Age Range	Non-Communicable Diseases				
	n (%)	Hypertension	Hiperglikemi	Hyperuricemia	Hypercholesterol
Age	8	3			
60-69	(26,7%)	(20%)	2 (50%)	4 (26,7%)	6 (27,3%)
	22	12			
≥ 70	(73,3%)	(80%)	2 (50%)	11 (73,3%)	16 (72,7%)
Total	30	15	4	15	22

Source: primary data 2025

The results of the examination of 30 respondents are shown in table 3.2. Patients aged >70 years are more numerous, namely 22 (73%) people compared to

60-69 years old (27%). The results of the examination also showed the distribution of Non-Communicable Diseases by Age, respondents who experienced hypertension were more at the age of >70 years, namely 12 people (80%) out of a total of 15 people who experienced hypertension. The results of Hyperglycemia showed the same number, namely 2 people (50%) out of a total of 5 people. In the results of Hyperuricemia, 11 people (73.3%) were found at the age of >70 years. Furthermore, in the results of the examination, 22 people were diagnosed with hypercholesterol and the most experienced by elderly patients > 70 years old, namely 16 people (72.7%).

The data of this study is in line with the theory that the age of >70 years has a higher risk of non-communicable diseases compared to young people. One way to control non-communicable diseases is to reduce and control risk factors through early detection (screening) (Alani et al., 2023). Early detection or screening aims to monitor disease risk factors so that it can be known as early as possible and can be followed up ((Alani et al., 2023) (Ministry of Health of the Republic of Indonesia, 2019)). Checking blood sugar, cholesterol and uric acid levels is one of the efforts to detect non-communicable diseases such as diabetes mellitus, cardiovascular and other non-communicable diseases (Susanti, 2022).

People with the age of >50 years are an age group that is vulnerable to non-communicable diseases, especially those related to metabolic disorders and degenerative diseases such as hypertension, diabetes mellitus, hyperuricemia, myalgia, muscle and joint pain, and other diseases. Elderly people living in nursing homes can experience health problems related to degenerative factors, eating habits, psychological and socioeconomic factors.

Table 3. Relationship between Clock Drawing Test and Random Blood Glucose Levels

Clock Drawing Test	Blood Glucose Levels		Total	p-value
	>200 (Increased)	< 200 (Normal)		
Impairment	9 100 %	0 0%	9	0,00
Normal	2 9,5%	19 90,5%	21	
Total	11	19	30	

Source : Primary data 2025

Based on the results of the research that has been conducted, it is found that there is a relationship between the Clock Drawing Test and Blood Glucose levels in elderly patients, described in the following table 3.

The results of this study show a significant relationship between blood glucose levels during and cognitive function based on the Clock Drawing Test (CDT). Of the 30 respondents examined, all elderly people who experienced impairment in CDT (100%) had blood glucose levels above 200 mg/dL. In contrast,

most respondents with normal CDT (90.5%) had glucose levels in the normal range. Chi-square analysis showed a value of $p=0.00$, which confirms that the relationship between current blood glucose levels and CDT results is statistically significant. These findings indicate that hyperglycemia contributes to a decline in cognitive function in the elderly.

These results are in line with the research of Munshi et al. (2016) which stated that the elderly with diabetes have a higher risk of developing cognitive impairment compared to those who have normal glucose levels. Underlying mechanisms include the neurotoxic effects of chronic hyperglycemia, oxidative stress, and cerebral microvascular damage that can disrupt the integrity of brain tissue. Biessels and Despa (2018) also added that uncontrolled glucose levels can accelerate the occurrence of memory and executive disorders, which can be detected through simple cognitive assessment instruments such as CDT.

Thus, the findings of this study support the previous literature that high blood glucose levels are one of the risk factors for cognitive function decline in the elderly. CDT can be used as a practical and simple screening tool to detect early cognitive impairment in the elderly with hyperglycemia. These results provide important implications for health services, namely the need to optimally control blood glucose levels as one of the prevention strategies for cognitive decline, while strengthening recommendations for the use of CDT in daily clinical practice in the geriatric population.

DISCUSSION

Decreased cognitive function in the elderly is often associated with metabolic factors, including blood glucose levels. One of the screening methods that is widely used to assess cognitive function is the Clock Drawing Test (CDT) which is simple, fast, and has good sensitivity in detecting cognitive impairments. Research conducted by the Indian Journal of Psychiatry (2020) shows that CDT can be used as an instrument for cognitive assessment in the elderly with diabetes mellitus, where the group of people with diabetes has a lower performance than the healthy control group. Although the study did not directly measure blood glucose levels at any time, the results reinforce the suspicion that impaired glucose regulation may affect cognitive performance.

A similar study was also conducted by Assuncao et al. (2018) which examined the relationship between metabolic syndrome and cognitive decline in hypertensive elderly without dementia using CDT. The results showed that the elderly with metabolic syndrome experienced a more significant decrease in CDT scores than the group without metabolic syndrome, and the condition became an independent predictor of decreased cognitive function. These findings are in line with a preliminary study conducted on the elderly at one of the posyandu, where respondents with blood glucose levels of >200 mg/dL tended to have lower CDT scores than the elderly with normal glucose levels. This suggests that the control of blood glucose levels plays an important role in maintaining cognitive function in old age, although more research is still needed to corroborate this empirical evidence (Watulingas et al., 2016).

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Thus, the findings of this study support the previous literature that high blood glucose levels are one of the risk factors for cognitive function decline in the elderly. CDT can be used as a practical and simple screening tool to detect early cognitive impairment in the elderly with hyperglycemia. These results provide important implications for health services, namely the need to optimally control blood glucose levels as one of the prevention strategies for cognitive decline, while strengthening recommendations for the use of CDT in daily clinical practice in the geriatric population.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions that we can make based on the results of the study show that there is a meaningful relationship between blood glucose levels during and cognitive function based on the Clock Drawing Test (CDT) in the elderly. All respondents with CDT impairment had blood glucose levels above 200 mg/dL, while the majority of respondents with normal CDT had normal glucose levels. These findings confirm that hyperglycemia plays an important role in the occurrence of impaired cognitive function in the elderly, so that blood glucose levels can be used as an indicator of the risk of cognitive decline.

Based on these results, it is recommended that blood glucose levels be routinely checked in the elderly as an effort to detect the risk of cognitive impairment. The use of the Clock Drawing Test (CDT) as a simple screening method can be integrated in primary health services, especially in health centers, to quickly identify the elderly who have the potential to experience cognitive decline. In addition, education and healthy lifestyle interventions, including dietary and physical activity settings, are needed to maintain stable blood glucose levels so that they can prevent or slow down the occurrence of cognitive impairment. Further research with larger sample sizes is also recommended to reinforce these findings and explore other factors that may contribute to cognitive function in the elderly.

FURTHER STUDY

This research still has limitations, especially in terms of sample collection that should be able to be done with a wider population. Therefore, the next researcher is expected to be able to make research with a larger sample target so that it can reach the community and contribute more widely.

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