Analysis of Kidney Function Test Profiles in Relation to the Incidence of Chronic Kidney Failure in Diabetes Mellitus Patients

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Article Info

ABSTRACT

Diabetes Mellitus (DM) is one of the most common chronic diseases worldwide and is a leading cause of chronic kidney failure (CKD). Kidney function tests such as urea levels, creatinine levels, and uric acid levels can be used to assess kidney condition and the risk of CKD development. To analyze the profile of kidney function tests in cases of chronic kidney failure in patients with diabetes mellitus. This study is an Analytical Observational research. The number of samples of diabetes mellitus patients with chronic kidney failure is 52 patients who underwent kidney function profile examinations including urea, creatinine, and uric acid. The data analysis used is descriptive analysis. Based on the obtained data, it was found that during this study, the respondents were predominantly male, with 36 individuals (69.2%), and in terms of age group, the respondents were predominantly in the 61-70 age group, with 15 individuals (28.8%). The average values of urea, creatinine, and uric acid in 52 samples of diabetes mellitus patients with chronic kidney failure were 123.05 mg/dl for urea, 4.85 mg/dl for creatinine, and 8.35 mg/dl for uric acid. The characteristics of the respondents based on gender were predominantly male, and the characteristics based on age were predominantly within the 61-70 year age group. The analysis results showed an increase in the values of kidney function test profiles (urea, creatinine, and uric acid) in diabetic patients with chronic kidney failure. It is evident from the average results of each kidney function test parameter that the average levels exceeded the normal range.

INTRODUCTION

Diabetes mellitus is a metabolic disorder or metabolic disease characterized by hyperglycemia caused by abnormalities in insulin secretion and insulin action. This can lead to damage or disruption of metabolic function and the failure of various organs, particularly the kidneys, eyes, nerves, heart, and blood vessels (Kesuma *et al*., 2023). Diabetes mellitus (DM) poses a threat to human health. Although this disease is not contagious, the number of sufferers will continue to increase (Imanuel Saputra *et al*., 2023).

The prevalence of diabetes mellitus continues to increase every year (Suharmanto, 2022). According to data from the International Diabetes Federation (IDF), 1 in 12 people worldwide suffer from diabetes mellitus, and on average, diabetes mellitus sufferers are unaware that they have the condition until it has progressed significantly with very evident complications (Lestari et al., 2021). According to the World Health Organization (WHO), the number of diabetes sufferers worldwide will increase from 463 million in 2019 to 700 million by 2045, an increase of 51% (Afriza, 2022). Based on data from Pusdatin (2018), the prevalence of diabetes sufferers in Indonesia in 2018 was around 10.9% of the population, causing 3.7 million deaths. Data from the NTB Provincial Health Office (2020) showed that 44.4% of diabetes mellitus sufferers in NTB (Zul Hendry *et al.*, 2023).

Currently, diabetes mellitus remains a global health issue. If not properly managed, this disease can develop into a chronic condition. This chronic state can cause kidney damage, leading to the kidneys losing their ability to maintain the balance of substances in the body (Ashari *et al.*, 2023). Patients with DM and kidney disease experience worse clinical manifestations compared to those with kidney disease alone (Tandjungbulu *et al.*, 2023). Kidney disease due to DM occurs in 40% of DM patients and is the leading cause of CKD worldwide (Tarigan *et al.*, 2020). Chronic Kidney Disease (CKD) is the deterioration of the kidneys' ability to cleanse the blood of toxic substances, leading to the accumulation of metabolic waste in the blood and urine (Chrisanto et al., 2022). Early-stage kidney disorder symptoms tend to be mild, making them difficult to diagnose with just clinical examinations. Laboratory tests can identify kidney dysfunction earlier (Aini & Mentari, 2019). Tests that can be performed to identify kidney issues include creatinine, urea, and uric acid tests.

Previous research (Ashari *et al.*, 2023) discussed the kidney profile of Prolanis patients with a history of Type II Diabetes Mellitus. (Ashari *et al.*,2023) aimed to describe the number of DM sufferers as well as the levels of urea, creatinine, and microalbumin in Prolanis participants. Based on previous research, the researchers intend to conduct further studies analyzing kidney function test profiles in relation to the incidence of chronic kidney disease in diabetes mellitus patients.

MATERIALS/METHOD

The type of research employed is descriptive observational with a cross-sectional approach based on medical record data. The technique used in this research is purposive sampling. The sample size of diabetic patients with chronic kidney disease is 52 patients who underwent kidney function profile examinations including urea, creatinine, and uric acid. The processed data are then analyzed using descriptive analysis.

RESULTS

Table 1. Characteristics of Respondents by Age and Gender
Subject Characteristics Based on Age and Gender of Diabetes Mellitus Patients experiencing CKD in Mataram City Hospital.

Variable	Category	Frequency	%

Age	<30	1	1.9
	31-40	4	7.7
	41-50	9	17.3
	51-60	12	23.1
	61-70	15	28.8
	71-80	7	13.5
	>80	4	7
Gender	Male	36	69.2
	Female	16	30.8

The characteristics of respondents based on age groups in the Mataram City Public Hospital are as follows: the age group <30 years consists of 1 person (1.9%), the age group 31-40 years consists of 4 people (7.7%), the age group 41-50 years consists of 9 people (17.3%), the age group 51-60 years consists of 12 people (23.1%), the age group 61-70 years consists of 15 people (28.8%), the age group 71-80 years consists of 7 people (13.5%), and the age group >80 years consists of 4 people (7.7%). The characteristics of respondents based on gender in the Mataram City Public Hospital are as follows: male respondents are 36 people (69.2%), and female respondents are 16 people (30.8%).

Table 2 Kidney Function Profile (Urea, Creatinine, and Uric Acid) in Patients with Diabetes Mellitus and Chronic Kidney Failure Incidence at Mataram City Hospital

Renal Function Test	Maximum Value	Minimum Value	Mean
Urea	33.10	294.50	123.05
Creatinine	1.09	13.22	4.85
Uric Acid	3.70	12.90	8.35

The average urea levels obtained in patients with diabetes mellitus and chronic kidney failure were 123.05 mg/dl. The lowest urea level recorded was 33.1 mg/dl and the highest was 294.5 mg/dl. The mean creatinine level in patients with diabetes mellitus and chronic kidney failure was 4.85 mg/dl. The lowest creatinine level was 1.09 mg/dl, and the highest was 13.22 mg/dl. The average uric acid level in patients with diabetes mellitus and chronic kidney failure was 8.35 mg/dl. The lowest uric acid level was 3.7 mg/dl, and the highest was 12.9 mg/dl.

DISCUSSION

In this study, it was found that patients with diabetes mellitus have a higher risk of experiencing chronic kidney failure (CKD). This is consistent with literature stating that diabetes mellitus is a primary cause of CKD (Tarigan *et al*., 2020). In a previous study (Suharmanto, 2022) on Lipid Profile and Kidney Function in Type 2 Diabetes Mellitus Patients, the measurement results showed that most respondents were aged 51-60 years, female, with poorly controlled diabetes, high blood sugar levels, normal urea levels, normal creatinine levels, and normal glomerular filtration rate (GFR).

The results of the study were compared with other research, such as the profile of CKD examination with hypertension. However, the occurrence of CKD in

patients with diabetes mellitus is still rare. The survival rate of diabetes and non-diabetes patients with CKD has increased in the last 10 years (N.Utami *et al*., 2023).

The research results indicate that the characteristics of respondents based on age groups at Mataram City General Hospital are dominated by the age group of 61-70 years old (28.8%). As people age, kidney function decreases, leading to a decline in filtration ability. Age factor can affect serum creatinine levels, with an increase in serum creatinine as age increases. This risk increases in patients with DM, as one of the disease progressions of DM leads to chronic kidney failure (Oktaviani, 2021). As age increases, kidney function decreases. With age, kidney function also declines. After the age of 40, a person starts to lose some nephrons, which are important filters in the kidney. Every decade of age increase, kidney function decreases by about 10 ml/min/1.73m². After the age of 40, there is a progressive decline in glomerular filtration rate until the age of 70, less than 50% of normal (Heriansyah *et al*., 2019).

The research results indicate that the characteristics of respondents based on gender at Mataram City General Hospital are dominated by males, with 36 people (69.2%). From the data obtained, it can be found that during this study, male patients were dominant. The results are in line with the estimates stated by the IDF (International Diabetes Federation) in 2019, which estimated the prevalence of diabetes in 2019 to be 9% in females and 9.65% in males (Regina, 2023).

Patients with DM and chronic kidney failure have increased levels of urea, creatinine, and uric acid. This research result, in line with previous research, states that the high value of urea in the blood in CKD patients is assumed to be due to kidney dysfunction that cannot excrete urea through urine, on average CKD patients with Diabetes Mellitus experience kidney dysfunction disorders leading to increased levels of blood urea (Istiqlal, 2018). Serum creatinine levels increase as kidney function decreases (Rukminingsih & Julianti, 2024). If serum creatinine levels double, it indicates a 50% decrease in kidney function, while a threefold increase indicates a 75% decrease in kidney function (Febrianisa *et al*., 2022). An increase in creatinine levels indicates kidney dysfunction as a complication of DM (Lifyowati *et a*l., 2022).

The results of this study, in line with previous research (Ilyas et al., 2017), indicate that patients with diabetes mellitus show an increase in uric acid levels. Some previous studies show different results from this study, such as a previous study (N. Utami *et al*., 2023) stating that CKD patients tend to have fewer uric acid diseases. In theory, the presence of uric acid stones causes pressure in the kidneys and blood vessels to rise. This results in increased thickness of blood vessel walls and reduced blood flow to the kidneys, leading to kidney damage (N. Utami *et al*., 2023).

CONCLUSIONS

The analysis indicates an increase in the values of kidney function test profiles (urea, creatinine, and uric acid) in patients with Diabetes Mellitus experiencing chronic kidney failure. It is evident from the average results of each parameter of these kidney function tests that the average values exceed the normal range. This research is expected to serve as a reference source of information for the advancement of health science in the field of Medical Laboratory Technology

concerning the analysis of kidney function test profiles in patients with Diabetes Mellitus experiencing chronic kidney failure.

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