Overview of Diabetic Nephropathy in Type 2 Diabetes Mellitus Patients at Royal Prima Hospital Medan Indonesia

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ABSTRACT

Diabetes Mellitus (DM) is a chronic disease characterized by blood glucose (blood sugar) levels exceeding normal. Diabetic nephropathy is a chronic microvascular complication that often occurs in diabetics. This study presents a picture of diabetic nephropathy in type 2 DM patients at the Royal Prima Hospital in Medan. This research is a type of descriptive research. The sample from this study was the total data of patients suffering from diabetic nephropathy who met the inclusion and exclusion criteria at Royal Prima Hospital from January 1, 2020 – to December 31, 2020. The inclusion criteria for the subjects of this study were complete patient medical records, type 2 diabetes patients, urinalysis tests. (proteinuria ≥ +2), renal function examination exceeds normal values, blood urea, and creatinine. The mean age of diabetic nephropathy patients was 57.52 years and the majority were 62 men (50.8%). The average picture of urea levels in diabetic nephropathy patients is 51.8 and the average creatinine level is 1.48. The majority of patients with diabetic nephropathy do not have proteinuria. And the average blood sugar level is 267 mg/dL. In conclusion, the incidence of diabetic nephropathy is highest in patients aged 57 years. The mean value of urea level is 51.80 mg/dl, creatinine value is 1.48 mg/dl, and the average blood sugar level is 267 mg/dl. Most proteinuria was in the negative category of as many as 107 people (87%).

1. Introduction

Diabetes Mellitus (DM) is a chronic disease characterized by blood glucose (blood sugar) levels exceeding normal, i.e. temporary blood sugar levels equal to or more than 200 mg/dl, and fasting blood sugar levels above or equal to 126 mg/dl. DM is called the silent killer because it is usually not noticed when complications are discovered.[1,2] The International Diabetes Federation (IDF) estimates that by 2019, at least 463 million people between the ages of 20-79 years will have diabetes worldwide, which is equivalent to 8.3% of the total prevalence of this age group. By gender, the IDF estimates that the prevalence of diabetes in 2019 is 9% for women and 9.65% for men.

The prevalence of diabetes is estimated to increase along with the age of the population which reaches 19.9% or 11.2 million people in the age group of 65 to 79 years. This number is expected to continue to increase, reaching 578 million in 2030 and 700 million in 2045.[3]

Diabetic nephropathy is a chronic microvascular complication that often occurs in diabetics. Diabetic nephropathy is defined as a clinical syndrome in diabetic patients characterized by persistent albuminuria > 300 mg/24 hours on at least two examinations within a period of 3 to 6 months.[4,5] The prevalence of diabetic nephropathy is approximately 15 to 25% in patients with type 1 diabetes mellitus and 25

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to 40% in patients with type 2 diabetes mellitus. The cumulative incidence of microalbuminuria in patients with type 1 diabetes mellitus in Europe is 12.6 to 33%. within 7 to 18 years of the course of diabetes mellitus, whereas in type 2 diabetes mellitus the annual incidence is 2.0%. In Japan, the prevalence of microalbuminuria in patients with type 2 diabetes mellitus is 32%. According to Ahmedani, the prevalence of microalbuminuria in type 2 diabetes mellitus in Karachi, Pakistan is 34%.8 In Indonesia, the prevalence of microalbuminuria in type 2 diabetes mellitus is 33%.6 This study presents an overview of diabetic nephropathy in type 2 DM patients at the Royal Prima Hospital in Medan.

2. Methods

This research is a type of descriptive research. Subject selection was carried out by looking at secondary data, namely, patient medical records which aimed to determine proteinuria levels in patients with type 2 diabetes mellitus at the Royal Prima Hospital in Medan, Indonesia. The sample from this study was the total data of patients suffering from diabetic nephropathy who met the inclusion and exclusion criteria at the Royal Prima Hospital from January 1, 2020 - to December 31, 2020. To determine the number of samples of respondents using the *purposive sampling method,* with inclusion criteria: Complete patient medical records, Patients with type 2 diabetes, Urinalysis (Proteinuria ≥ +2), Kidney function tests exceed normal values, Blood urea (normal 15 – 38 mg/dL), Creatinine (normal 0.55 – 1.30 mg/dL). Data collection was taken by collecting medical record data of diabetic nephropathy patients in type 2 diabetes mellitus patients at Royal Prima Hospital from January 1, 2020 - to December 31, 2020.

3. Results

Based on table 1 it can be seen that the average age of patients with diabetes mellitus nephropathy is 57.52 years and the majority are male. -men as many as 62 people (50.8%). The average picture of urea levels in diabetic nephropathy patients is 51.8 and the average creatinine level is 1.48. The majority of patients with diabetic nephropathy do not have proteinuria. And the average blood sugar level is 267 mg/dL.

Table 1. Demographic and clinical characteristics of diabetic nephropathy patients

Age	Mean±SD	Min-Max
	57.52±10.27	30-89
Gender	Frequency	Percentage (%)
Male	62	50.8
Female	60	49.2
Ureum Level	Mean±SD	Min-Max
	51.8±50.29	10 -378Level
Creatinine Level	Mean±SD	Min-Max
	1.48±2.5	0-17
Protein	Mean±SD	Min-Max
	0.72	0-3
Protein	Frequency	Percentage (%)
Negative	107	87.7
Positive 1	3	2.4
Positive 2	8	6.6
Positive 3	4	3.3
Blood Sugar Level	Mean±SD	Min-Max
	267±133.7	32-585

4. Discussion

The results showed that the average urea level was 51.80 and the creatinine level was 1.48. The results are in line with the study which stated that 18 people had high creatinine levels, dominated by the age group 61-70 years, namely 9 people (50%) in Type 2 DM patients.[7] Other studies stated that there was a correlation between HbA1c values and creatinine levels. in patients with type 2 diabetes. There is a significant correlation between the value of HbA1c and creatinine levels in patients with type 2 diabetes with p-value = 0.021 and has a moderate positive correlation strength with a value of r = 0.333.[8]

Diabetic nephropathy is a complication of kidney function disorders that can cause kidney failure in DM patients. A person with diabetes who has experienced complications of kidney failure accompanied by an increase in blood pressure will result in decreased glomerular filtration and ultimately end-stage renal failure. Kidney failure will increase creatinine levels, this is because creatinine will no longer be able to be filtered and secreted completely by the kidneys. High blood glucose levels in the body can slowly damage the filtration membrane, because glucose will react with proteins so that it can change the structure and function of cells, including the glomerular basement membrane. The damaged protein barrier layer will result in protein leakage into the urine (albuminuria), which can lead to impaired kidney function.[9-13]

The results showed that most patients with protein negative (87.7%), positive 1 (2.4%), positive 2 (6.6%). Positive 3 (3.3%). The results of this study are in line with studies that state that Type II DM patients have a degree of proteinuria +3 (27.1%).[14-16] Diabetes mellitus is a chronic disease caused by genetics or due to an acquired deficiency of insulin secretion by the pancreas. Hyperglycemia or increased levels of glucose in the blood is the most common effect of diabetes mellitus and the most difficult to control, causing serious damage to other body systems, especially the nerves and blood vessels. Diabetic nephropathy is one of the microvascular complications of type 2 diabetes mellitus. The risk factors for diabetic nephropathy are uncontrolled diabetes, increased blood pressure, age, duration of diabetes, smoking, obesity, family history, and poor blood sugar control.[17-20]

The results showed that the average value of blood sugar levels in this study was 267 mg/dl. Several etiological factors for diabetic nephropathy are uncontrolled blood sugar levels (fasting blood sugar > 140–160 mg/dl); genetic factors; hemodynamic abnormalities (increased renal blood flow and GFR, increased intraglomerular pressure); systemic hypertension; insulin resistance syndrome (metabolic syndrome); inflammation; changes in vascular permeability; excess protein intake; metabolic disorders (abnormalities of polyol metabolism, formation of advanced glycation and products, increased production of cytokines); release of growth factors; disorders of carbohydrate or fat or protein metabolism; structural abnormalities (glomerular hypertrophy, mesangial expansion, thickening of the glomerular basement membrane); impaired ion pumps (increased $Na^+ - H^+$ pump and decreased $Ca^{2+} - ATPase$ pump); dyslipidemia (hypercholesterolemia and hypertriglyceridemia); protein kinase-C activation.[21]

Diabetic nephropathy (ND) is a complication that often occurs in diabetics. Diabetic nephropathy is defined as a clinical syndrome in diabetic patients characterized by persistent albuminuria > 300 mg/24 hours on at least two examinations within a period of 3 to 6 months. The pathophysiology of ND is the presence of hyperfiltration. Until now, hyperfiltration is still considered as the beginning of the pathogenic mechanism in the rate of kidney damage. The mechanism for the increase in GFR in ND is probably due to afferent arteriolar dilatation by a glucose-dependent effect mediated by the vasoactive hormone IGF-1, Nitric Oxide, prostaglandins, and glucagon. The direct effects of hyperglycemia are stimulation of cell hypertrophy, extracellular matrix synthesis, and the production of TGF-β which is mediated by the activation of protein kinase-C (PKC), which belongs to serine-threonine kinases that have vascular functions

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such as contractility, blood flow, cell proliferation, and capillary permeability. Chronic hyperglycemia can lead to nonenzymatic glycation of amino acids and proteins (Mallard and Browning reaction).[22]

Initially, glucose will bind to amino acid residues non-enzymatically to become Schiff glycation bases, then rearrangement occurs to reach a more stable but still reversible form and is referred to as the Amadori product. If this process continues, irreversible Advanced Glycation End Products (AGEs) will occur. AGEs are thought to mediate several cellular activities such as the expression of adhesion molecules that play a role in the withdrawal of mononuclear cells, as well as in the occurrence of cell hypertrophy, extracellular matrix cell synthesis, and inhibition of Nitric Oxide synthesis. This process will continue until there is an expansion according to the stages in Mogensen. Hypertension that occurs together with increased kidney damage will also encourage sclerosis in the kidneys of DM patients. It is thought that hypertension in DM is mainly caused by intrarenal or intraglomerular efferent arteriolar spasm.[23]

5. Conclusion

The incidence of diabetic nephropathy was highest in patients aged 57 years. The highest incidence of diabetic nephropathy was in the male sex, 62 people (50.8%). The mean value of urea level is 51.80 mg/dl, creatinine value is 1.48 mg/dl, and the average blood sugar level is 267 mg/dl. Most proteinuria was in the negative category as many as 107 people (87%).

6. References

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