ISSN No:-2456-2165

Differences of Hypertension in the Case of Controlled and Uncontrolled Diabetes Mellitus Type 2 In Pirngadi General Hospital Medan

Rahmadani Sitepu[1], Elaninanivi Br Tarigan[2], Ida Yustina[3] Heru Santoso[3]
[1]Medical Faculty Lecturer UISU Medan, [2]Faculty of Public Health Postgraduate Student USU, [3]Public Health Lecturer USU

Abstract:- Diabetes mellitus is a chronic metabolic disorder which is obtained by absolute or relative insulin deficiency and impaired insulin function. Uncontrolled Diabetes Mellitus can lead to various complications; one of them is macrovascular or microvascular which can be characterized by increasing the blood pressure (hypertension). This study aims to look at the differences of hypertension in the case of controlled and uncontrolled Diabetes Mellitus Type 2 in Pirngadi General Hospital Medan. The type of this research is observational with cross sectional approach. Samples are 42 people. They are taken from medical records and the results will be analyzed by doing univariate and bivariate.

The results showed there is a difference between the incidence of hypertension in diabetes mellitus type 2 cases are controlled and uncontrolled in Pirngadi General Hospital Medan Year 2015 where p = 0.0001. Hopefully this research is useful for the public and the health institutions and also for the further researcher.

Keywords:- *Diabetes Mellitus, Hypertension, RSUD Pirngadi.*

I. INTRODUCTION

Non-communicable disease (NCD) is a chronic disease. It is not transmitted from person to orang. Non-communicable diseases have a long duration and they are generally develop slowly. According to WHO, there are four types of Non-communicable diseases, such as cardiovascular disease (coronary heart disease, stroke), cancer, chronic respiratory diseases (asthma and chronic obstructive pulmonary disease), and diabetes. Data were obtained through respondents' questions / interviews about non-communicable diseases which are consisting of Asthma, Chronic Obstructive Pulmonary Disease (COPD), Cancer, Diabetes Mellitus (DM), Hyperthyroidism, Hypertension, Coronary Heart Disease, Heart Failure, Stroke, Chronic Kidney Failure (CKF), Kidney Stones, Joint Disease / Rheumatism.[10]

Diabetes mellitus is a chronic metabolic disorder resulting from the pancreas, it does not produce enough insulin. It order words, the body can not use the insulin that is produced effectively. Insulin is a hormone that regulates blood sugar balance. As the consequences, there is the increasing in blood glucose concentration (hyperglycemia). According to the World Health Organization (WHO), DM is a collection of anatomic and chemical problems due to a number of factors where absolute or relative insulin deficiency is obtained and impaired insulin function.[12]

According to the data from WHO, there are the top 10 countries with a higher diabetes prevalence, namely Tokelau 37.5%, Federated States of Micronesia 35%, Marshall Islands 34.9%, Kiribati 28.8%, Cook Islands 25.7%, Vanuatu 24% , Saudi Arabia 23.9%, Nauru 23.3%, Kuwait 23.1% and Qatar 22.9%. The International Diabetes Federation (IDF) estimates that the prevalence of DM worldwide is 1.9% and it makes DM as one of the 7th leading causes of the death in the world.[3]

Based on the research conducted by DiabCare in 12 countries in Asia, it showed that the number of people with type 2 diabetes mellitus with poor blood glucose control up to 68%. Meanwhile, there are several studies in various countries showed that the number of people with type 2 diabetes mellitus who have uncontrolled blood sugar levels is still high, such as in Malaysia at 69.2% and Thailand at 53.5, 6 countries in Latin America show that 57% of glucose control blood in type 2 DM sufferers have a bad category.[9]

In the second edition of diabetes atlas 2003 published by IDF, the prevalence of DM in Indonesia in 2000 was 1.9% (2.5 million people) and impaired glucose tolerance (TGT) 9.7% (12.9 million people) with prediction that in 2025, it will be 2.8% (5.2 million people) DM and 11.2% (20.9 million people) with TGT.[10]

The reports from the result of the researches in various regions in Indonesia are carried out in the 1980s; it showed the distribution of the prevalence of type 2 DM from 0.8% in Tanah Toraja, up to 6.1% obtained in Manado. Research results in the 2000 era showed a very sharp increase in prevalence. For example, the research in Jakarta (urban areas) from DM prevalence of 1.7% in 1982 up to 5.7% in 1993 and then it became 12.8% in 2001 in Jakarta's sub-urban areas. Similarly, the prevalence of DM at the point of view (urban areas), it increased from 1.5% in 1981 up to 3.5% and it became 12,5% in 2005.[7]

Research which is conducted by Arifin in a small town in West Java, it showed that figure is only 1.1%. In a remote area in Tanah Toraja, the prevalence of DM was only 0.8%. It is clear, there is a difference between urban and rural, showing that lifestyle influences the incidence of DM. In East Java, the figures are not different; it is about

1.43% in urban areas and 1.4% in rural areas. This might be due to the high prevalence of Diabetes Mellitus Related to Malnutrition (DMTM) which is now categorized as pancreatic type DM in East Java, by 21.2% in all DM in rural areas.[13]

According to Basic Health Research (BHR) who conducted an interview to calculate the proportion of DM for ages 15 years and over; It is done to get the information that there were 160,913 in North Sumatra area who had been diagnosed with DM by a doctor and 44,698 had never had diabetes by a doctor, but in the last month, they experienced symptoms of frequent hunger, frequent thirst, frequent urination and weight loss (Ministry of Health, 2014). According to the results of research conducted by DiabCare in Indonesia, it is known that 47.2% have poor control of fasting blood glucose> 130 mg / dl in diabetics with type 2.[9]

From various epidemiological studies, it has been clearly proven that the incidence of DM has increased overall in all countries. The researches which were done in Indonesia, especially Jakarta and various major cities in Indonesia also clearly showed a similar trend. The increasing in the incidence of exponential DM will certainly be followed by an increased possibility of complications, especially for those who cannot control their blood glucose levels. Chronic complications as the result of both microvascular blood vessels blokage such as retinopathy, nephropathy and macrovascular diseases; as coronary arteries and lower leg veins .[12]

One of the risk factors for macrovascular complications is hypertension. The frequency of hypertension increases in type 1 and type 2 DM and it is associated with an increased total extracellular Na + content, which causes volume expansion and suppression of rennin.[4]

UKPDS study showed there were 13% increase in microvascular disorder accompanied by a mixture of 12% increase in myocardial infarction (IM) as a result of microvascular disease which caused by hypertension and diabetes. Moreover, 50% of patients with type 2 DM are hypertensive patients or are undergoing antihypertensive therapy at the time the diagnosis is made. In one study, it was said that 75% of adult DM patients suffer from hypertension, the figure of which can increase 80% if the patient is microalbuminuria and more than 90% if the patient experiences clinical nephropathy. Meanwhile, as many as 30-43% of adult patients with type 1 diabetes suffer from hypertension, but the condition is almost always accompanied by nephropathy.[2]

According to previous studies conducted at Internal Medicine Polyclinic in Karanganyar District Hospital in July 2012, it can be concluded that there is a significant relationship between blood sugar levels and hypertension in diabetes mellitus patients with type 2.[5]

Hypertension or high blood pressure is an increased systolic blood pressure which is greater than 140 mmHg and diastolic blood pressure over 90 mmHg on two occasions with an interval of five minutes with enough rest / quiet. Increased blood pressure that lasts for a long time (persistent) can cause kidneys damage (kidney failure), heart (coronary heart disease) and brain (causing strokes). If it is not detected early and receive adequate treatment, many hypertensive patients with uncontrolled blood pressure and the number continues to increase.[3]

According to the American Heart Association (AHA), the American population whose aged over 20 years suffer from hypertension has reached up to 74.5 million, however, almost 90-95% of the cases are unknown. (RI Ministry of Health, 2014). Data from The National Health and Nutrition Examination Survey (NHNES) shows that from 1999-2000, the incidence of hypertension in adults was around 29-31%, which means there were 58-65 million people with hypertension in America, and there was an increase of 15 million from NHANES III data from 1998-1991.[15]

The prevalence of hypertension in Indonesia is obtained through the measurements at the age of ≥18 years at about 25.8%, the highest in Bangka Belitung 30.9%, followed by South Kalimantan 30.8%, East Kalimantan 29.6% and West Java 29.4%. The prevalence of hypertension in Indonesia which is obtained through a questionnaire diagnosed by health workers is 9.4%, diagnosed by health workers or taking medication is 9.5%. So, there is 0.1% who take the medicine by themselves. Respondents who had normal blood pressure but currently were taking hypertension medication by 0.7%. So the prevalence of hypertension in Indonesia is 26.5% (25.8% + 0.7%).[10]

In 2013, it showed that nationally 25.8% of Indonesia's population by using an individual unit of analysis suffered from hypertension. If the current population of Indonesia is 252.124.458 people, there are 65,048,110 people suffering from hypertension. There are 13 provinces whose percentage exceeds the national figure, with the highest in Bangka Belitung Province (30.9%) or in absolute terms 30.9% x 1,380,762 souls = 426,655 inhabitants.[3]

The prevalence of hypertension by blood pressure measurements in the area of North Sumatra in 2007, it is known, there were 25.8% of patients with hypertension. While in 2013, there was a decline to 25.0% of people with hypertension. This decrease could occur because of various kinds of factors, such as different blood pressure gauges, people who have begun to be aware of the dangers of hypertension.[3]

Based on a preliminary survey conducted at RSUD Dr Pirngadi Medan city, it was found that there were 249 patients who suffer DM with hypertension in the period of January-December 2015.

ISSN No:-2456-2165

Based on the above data, the researcher is interested to see how is the difference in the incidence of hypertension in cases of diabetes mellitus type 2 controlled and uncontrolled in RSUD dr Pirngadi Medan?

➢ *Research purposes*

- Knowing the incidence of hypertension in cases of controlled type 2 diabetes mellitus in RSUD dr Pirngadi Medan
- Knowing the incidence of hypertension in cases of uncontrolled type 2 diabetes mellitus in RSUD dr Pirngadi Medan
- Knowing the difference in the incidence of hypertension in cases of controlled and uncontrolled type 2 diabetes mellitus in RSUD dr Pirngadi Medan

➢ *Benefits of the Research*

- For the Health Agencies, it as as the source of information for planning a health implementation strategy to reduce the incidence of hypertension in the cases of diabetes mellitus.
- For the Community, it is as a source of information about the incidence of hypertension in cases of controlled and uncontrolled Type 2 Diabetes Mellitus
- For further researchers, it can add insight and knowledge about the incidence of hypertension in cases of Type 2 Diabetes Mellitus

II. RESEARCH METHODOLOGY

This type of research is observational analytic research with *cross sectional* approach. In a *cross sectional* study, cause or risk and effect variables or cases that occur in the study object are measured or collected simultaneously (at the same time) .[6] This research will look for the differences in the incidence of hypertension in cases of controlled and uncontrolled type 2 diabetes mellitus in Hospital Dr Pirngadi, Medan.

The location of this research was conducted at the Regional Hospital Dr. Pirngadi Medan. The selection of the location of this research was based on the preliminary survey data at RSUD Dr. Pirngadi that obtained the amount of data of patients with Diabetes Mellitus with Hypertension around 249 patients in the period of January-December 2015. The time of this research starts from June 2016 up to January 2017.

Samples were taken from patients with type 2 diabetes mellitus who fulfill the inclusion criteria in Regional General Hospital Pirngadi, Medan. The inclusion criteria of this research are: a. early diagnosis of type 2 diabetes mellitus without complications, b. Medical record that contains blood pressure data HbA1C. The instrument in this study was medical record obtained from Regional General Hospital Pirngadi Medan in 2015. As a tool for data collection in this study, the researchers used checklist sheets which were adjusted to the purpose of the study and referred to the conceptual framework that was created.

The analysis used in this research is univariate analysis to describe data such as average, median, proportion and so on. Besides that it also used bivariate analysis to state the analysis of two variables namely the independent variable and the dependent variable which are allegedly related. The selected bivariate test is the *Fisher's Exact Test*, where if the p value <0.05, the hypothesis is accepted.[1]

III. RESEARCH RESULT

This research was conducted at Regional General Hospital Doctor Pirngadi at Jalan Professor H.M Yamin SH. No. 47, Perintis, Medan Timur Kota Medan, North Sumatra, Indonesia. RSUD Dr. Pirngadi is a state-class B hospital which is one of the health service units in Medan that is owned by Medan city government. In addition, this hospital also receives referral services from district hospitals. Based on the Decree of the Minister of Health of the Republic of Indonesia number: 433 / Menkes / SK / IV / 2007 dated April 10, 2007, RSUD Dr. Pirngadi was designated as a teaching hospital.

The respondents in this research were patients at Regional General Hospital, Pirngadi Medan, whose initial diagnosis was Type 2 Diabetes Mellitus, both female and male with a vulnerable age of around 35 - 75 years. The respondents who were sampled fulfilled the inclusion criteria that have been set out in this reserach. The amount of the respondents in this study are around 42 people. From the overall respondents, it is obtained an overview of some of the characteristics present in the form of age and gender.

Age	Frequency	Percentage (%)
36 – 45	4	9.5
46 – 55	13	31.0
56 – 65	18	42.9
66 – 75	7	16.7
Total	42	100

Table 1:- Distribution of Respondents by Age

From the table above, it can be seen from 42 respondents, there are the number of respondents in the 36-45years age group totaling 4 people (9.5%), 46-55 years totaling 13 people (31.0%), 56-65 years totaling 18 people (42.9%), and 66-75 years totaling 7 people (16.7%).

Gender	Frequency	Percentage(%)
Male	21	50
Female	21	50
Total	42	100

Table 2:- Frequency Distribution of Respondents by Gender

ISSN No:-2456-2165

Based on the above table, it is found that both female and male respondents have the same amount. The amounts of female respondents are 21 people (50%) while the male respondents are also 21 people (50%).

➢ *Univariate Analysis*

Univariate analysis was carried out on each research variable. In this analysis, it will produce a frequency distribution and percentage of each variable related to the incidence of hypertension in DM Type 2 in Regional General Hospital Pirngadi Medan.

Blood Pressure	Frequency	Percentage (%)
Hypertension	30	71,4
No Hypertension	12	28,6
Total	42	100

Table 3:- Frequency Distribution of Respondents with Hypertension

Based on the table above, it is obtained the frequency distribution of respondents who suffer from hypertension were 30 people (71.4%) while those without hypertension were 12 people (28.6%)

DM based on HbA1C	Frequency	Percentage (%)
Controlled DM	25	50,5
Uncontrolled DM	17	40,5
Total	42	100

Table 4:- The Controlled and Uncontrolled DM Type 2 Respondent Frequency Viewed From HbA1C Value

Based on the table above, it is found that the frequency distribution of controlled type 2 DM patients is 25 people (50.5%) and uncontrolled type 2 DM sufferers are 17 people (40.5%)

Age	DM				
	Controlled		Uncontrolled		Total
	F	%	F	%	
36 – 45	3	7,1	1	2,3	4
46 – 55	8	19,0	5	11,9	13
56 – 65	11	26,1	7	16,7	18
66 - 75	3	7,1	4	9,5	7
Total	25	59,3	17	40,4	42

Table 5:- Type 2 DM Frequency Distribution by Age

From the table above, it is found that type 2 DM controlled for ages 36-45 years were 3 people (7.1%), ages 24-55 years were 8 people (19.0%), aged 56-65 years were 11 people (26.1%), age 66.75 years were 3 people (7.1%) while in uncontrolled type 2 DM for ages 36-45 years were 1 person (2.3%), ages 46-55 years were 5 people (11.9%), aged 56-65 years were 7 people (16.7%), and for ages 66-75 years, there were 4 people (9.5%).

Gender	DM				Total
	Controlled		Uncontrolled		
	F	%	F	%	
Male	13	30,9	8	19,0	21
Female	12	28,5	9	21,4	21
Total	26	59,4	17	40,4	42

Table 6:- DM Type 2 Frequency Distribution Based on Gender

From the table above, it was found that type 2 diabetes that was controlled with male gender was 13 people (30.9%), and female gender was 12 people (28.5%) whereas in type 2 diabetes that was uncontrolled with male gender was 8 people (19.0%) and female gender was 9 people (21.4%).

Age	HYPERTENSION				
	Yes		No		Total
	F	%	F	%	
36 – 45	3	7,1	1	2,3	4
46 – 55	10	23,8	3	7,1	13
56 – 65	12	28,5	6	14,2	18
66 - 75	5	11,9	2	4,7	7
Total	30	71,3	12	28,3	42

Table 7:- Distribution of Hypertension Frequency by Age

From the table, it can be seen hypertension patients aged 36-45 years were 3 people (7.1%), aged 46-55 years were 10 people (23.8%), aged 56-65 years were 12 people (28.5), age 66-75 numbered 5 people (11.9) while the patients without hypertension with age 36-45 years were 1 person (2.3%), age 46-55 years were 3 people (7.1%), age 56 -65 years were 6 people (14.2), aged 66-75 years were 2 people (4.7%).

Gender	HYPERTENSION				Total
	Yes		No		
	F	%	F	%	
Male	16	38,0	5	11,9	21
Female	14	33,4	7	16,7	21
Total	30	71,4	12	28,6	42

Table 8:- Distribution of Hypertension Frequency by Gender

The table above shows hypertension patients with male gender were 16 people (38.0%), and female gender were 14 people (33.4%) while patients who did not have hypertension with male gender were 5 people (11.9%) and female gender were 7 people (16.7%).

DM	HYPERTENSION		Total
	Yes	No	
No	17	0	17
Controlled	13	12	25
Total	30	12	42

Table 9:- Ratio Prevalence

Prevalence in the exposed group: a/a+b = 17/17 = 1
Prevalence in the unexposed group : c/c+d = 13/23 = 0,52

$$\text{Ratio Prevalence} = \frac{\text{Prevalence in the exposed group}}{\text{Prevalence in the unexposed group}} = \frac{1}{0{,}52} = 1{,}9$$

The table above shows the prevalence in the exposed group was 1, while the prevalence in the unexposed group was 0.52. Then the prevalence ratio in the research was 1.9.

➢ *Bivariate Analysis*

Bivariate analysis is used to determine the difference between the independent variable and the dependent variable. The following are the bivariate data on the differences in the incidence of hypertension in controlled and uncontrolled type 2 DM patients.

DM	HYPERTENSION				P value
	Yes		No		
	F	%	F	%	
Uncontrolled	17	56,7	0	0	0,0001
Controlled	13	43,3	12	100	
Total	30	100	12	100	

Table 10:- Analysis of the Differences in the Occurrence of Hypertension in Controlled and Uncontrolled Type 2 DM

From the above table, it can be concluded that in controlled type 2 DM patients, there were 13 people (30.9%) had hypertension while in uncontrolled type 2 DM patients, it was found 17 people (40.4%) had hypertension. The statistical results of the *Fisher's Exact Test* showed there were the differences in the incidence of hypertension in controlled and uncontrolled type 2 DM in General Hospital Pirngadi Medan with p value = 0,0001 at 95% *confidence interval*.

➢ *The Discussion of Univariate Results*

Based on the results, most patients with Type 2 diabetes at the age of 56-65 years were 18 people (42.8%), followed by the age of 46-55 years as many as 13 people (30.9%). The results are consistent with the research conducted by Awad et al (2011) in Manado that one of the risk factors for type 2 diabetes occurred is at the aged > 40 years. Another study conducted by Ari Fatmawati (2010) in Semarang found that from 74 cases, there were 22 people (29.7%) from the respondents diagnosed with DM at the age of less than 40 years and there were 52 people (70.3%) from the respondents who were diagnosed with DM at the age of more than 40 year. This is consistent with the explanation put forward by Soegondo who said screening tests for DM were performed in groups with one of the risk factors being age ≥ 45 years.

The results showed that the respondents are male or female has the same amount, respectively 21 people (50%). The results are consistent with the research conducted by I Gusti Made Geria Jelantik (2014) in Mataram that there is no evidence of a significant relationship between gender and the incidence of type 2 DM. DM is a collection of symptoms in a person who experienced an increase in blood glucose sugar levels due absolute and relative insulin hormone deficiency. When the fat content in the blood increases due to foods that contain cholesterol, the more insulin is used to burn the fat. As a result, the body lacks the hormone insulin to facilitate the metabolism of sugar in the blood. Thus, every person with male or female gender has the same risk of developing diabetes if the diet is not good. (Price & Wilson, 2005).

The results also showed 12 (28.5%) patients with hypertension at the age of 56-65 years are 12 people (28.5%). This study is in line with Zamhir Setiawan's research found that at the age of 25-44 years the prevalence of hypertension was 29%, at the age of 45-64 years at 51% and at the age of tahun 65 years at 65%. This is related to the changes in cardiovascular structure and function. As we get older, the ventricular walls and heart valves thicken and the elasticity of the blood vessels decreases. *Atheroclerosis* increases due to an unhealthy lifestyle. This is what causes an increase in systolic and diastolic press which has an impact on increasing the blood pressure.[14]

Based on the results of the study, it was found that men are the most patients suffering from hypertension. The amounts are around 16 people (38.0%). This is in line with the results of research conducted by Farida Nur Aisyiyah. Generally, the prevalence of hypertension in men is greater than in women. It is around 50.2% while women are around 48.3%. The research of Ekowati Rahajeng and Sulistyowati Tuminah in 2009 suggested that men have a high risk for hypertension. This result is not in accordance with the research conducted by Hesti Rahyu (2012) which stated that the incidence of hypertension is not influenced by gender. Men more likely to have hypertension is often triggered by unhealthy behaviors such as smoking and alcohol consumption, depression and low status jobs and feeling uncomfortable on employment and unemployment.

Pravelensi ratio is the ratio between the prevalence of a disease or the effects on the subjects that have a group of risk factors, the prevalence of disease or the effects on subjects who do not have risk factors (Sastroasmoro, 2014). Prevalence ratio in this study was 1.9 where if the value of the prevalence ratio > 1 means that a person suffering from

type 2 diabetes uncontrolled have 1.9 times greater risk of hypertension which is greater compared to patients with uncontrolled type 2 diabetes.

- *The Discussion of Bivariate Results*

The results of the research conducted at the General Hospital Pirngadi Medan showed that there were differences in the incidence of hypertension in controlled and uncontrolled type 2 DM cases in 2015 with a p value = 0.0001, where if the p value < 0.05 then the research hypothesis was accepted.

This study is paralel with Mutmainah's research (2013). There is a relationship between blood sugar levels and hypertension in type 2 DM patients. This study is also paralel with the research conducted by Subiantoro (2002) in Semarang, states that there are differences in systolic and diastolic blood pressure in patients with type 2 diabetes who are controlled and uncontrolled.

Another study conducted by Guicheng Peng (2013) in 17 villages in South China with the inclusion criteria were patients with type 2 diabetes in the aged > 30 years. The results of this study state that the people with type 2 diabetes where the HbA1C value > 6.5% has hypertension and has a high risk for cardiovascular disease.

It can increase vascular rigidity by promoting vascular structural changes in chronic hyperglycemia At high concentrations, glucose exerts toxic effects on endothelial cells which resulting in decreased endothelial-mediated vascular relaxation, which will increase constriction and hyperplasia of vascular smooth muscle cells and vascular remodeling.

In addition, there is evidence that hyperglycemia can accelerate the formation of nonenzymatic glycosylation products that gather on vessel wall proteins. Glycosylation is a covalent bond between blood glucose and red blood cells, specifically hemoglobin (HbA1C). Normally, there are around 4.5% -6% glucose bound.

Insulin resistance plays a role in the pathogenesis of hypertension. Insulin stimulates the sympathetic nervous system increases renal sodium reabsorption which affects cation transport and results in hypertrophy of vascular smooth muscle cells. So, it was concluded that hypertension as the results of insulin resistance occurs due to an imbalance between the pressor and depressor effects. [11]

IV. CONCLUSIONS

- Based on the HbA1C values, there were 25 people (50.5%) of Type 2 DM patients who were controlled and 17 people (40.5%) of Type 2 DM patients who were not controlled.
- Most patients with type 2 diabetes experience is between the ages of 56-65 years. It is about 18 people (42.8%) and there was no difference between male and female genders.
- Most sufferers have hypertension at the age of 56-65 years which amounted to 12 people (28.5%) and male sufferers more than female, amounting to 16 people (38.0%)
- There is a difference between the incidence of hypertension in controlled and uncontrolled type 2 DM cases in Pirngadi General Hospital Medan in 2015. Where p = 0.0001 with a prevalence ratio of 1.9.

SUGGESTIONS

- It is suggested for Health Agencies especially for the Doctors in Pirngadi General Hospital Medan, they can improve health services to reduce the incidence of hypertension in type 2 DM.
- It is recommended for the society that they should always control their blood sugar levels and still maintain a lifestyle to avoid DM type 2 disease or its complications.
- Finally, further research on the differences in hypertension in type 2 diabetes cases are controlled and uncontrolled are needed to be done by the further researchers.

REFERENCES

[1]. Dahlan, M Sopiyudin., 2014. *Medical and Health Statistics*. 6th Edition. Jakarta: Indonesia Epidemiology
[2]. Donelly, Richard & Bilous, Rudy., 2015. *Hypertension in Diabetes Mellitus in Diabetes Handbook; 4th Edition*. Jakarta: Bumi Medika
[3]. American Diabetes Association. Cardiovascular Disease and Risk Management. Diabetes Care. 2017; 40(Suppl 1):S75–87.
[4]. Wong WT, et al. Endothelial dysfunction in diabetes and hypertension: cross talk in RAS, BMP4, and ROS-dependent COX-2-derived prostanoids. J Cardiovasc Pharmacol. 2013; 61(3):204–14.
[5]. Holman RR, et al. Long-term follow-up after tight control of blood pressure in type 2 diabetes. N Engl J Med. 2008; 359(15):1565–76
[6]. The ACCORD study group. nine-year effects of 3.7 years of intensive glycemic control on cardiovascular outcomes. Diabetes Care. 2016; 39(5):701–8.
[7]. Yusuf S, et al. Blood-pressure and cholesterol lowering in persons without cardiovascular disease. N Engl J Med. 2016; 374(21):2032–43.
[8]. McBrien K, et al. Intensive and standard blood pressure targets in patients with type 2 diabetes mellitus. systematic review and meta-analysis. Arch Intern Med. 2012; 172(17):1296–303.
[9]. Emdin CA, et al. Blood pressure lowering in type 2 diabetes: A systematic review and meta- analysis. JAMA. 2015; 313(6):603–15.
[10]. Bakris GL, et al. Preserving renal function in adults with hypertension and diabetes: a consensus approach. National Kidney Foundation Hypertension and Diabetes Executive Committees Working Group. Am J Kidney Dis. 2000; 36(3):646–61.

[11]. Magnan EM, et al. The relationship of individual comorbid chronic conditions to diabetes care quality. BMJ Open Diabetes Res Care. 2015; 3(1):e000080.
[12]. Nowlin SY, et al. Diet, inflammation, and glycemic control in type 2 diabetes: An integrative review of the literature. J Nutr Metab. 2012; 2012:542698.
[13]. Sowers JR, et al. Diabetes, hypertension, and cardiovascular disease: an update. Hypertension. 2001; 37:1053–1059.
[14]. Carson AP, et al. Ethnic differences in hypertension incidence among middle-aged and older adults: the multi-ethnic study of atherosclerosis. Hypertension. 2011; 57:1101–1107.
[15]. 15. Liu X, Song P. Is the association of diabetes with uncontrolled blood pressure stronger in Mexican Americans and Blacks than in Whites among diagnosed hypertensive patients? Am J Hypertens. Jul 17.2013.