**INFLUENCED HYPERTENSION and HDL on THE INCIDENCE of KIDNEY FAILURE COMPLICATION in DM TYPE II PATIENTS**

Enda Silvia Putri

Public Health Faculty Teuku Umar University, Indonesia, endasilviaputri@utu.ac.id

Marniati

Public Health Faculty Teuku Umar University, Indonesia, marniati@utu.ac.id

Arfah Husna

Public Health Faculty Teuku Umar University, Indonesia, arfahhusna@utu.ac.id

Arfriani Maifizar

Social and Politic Science Faculty Teuku Umar University, Indonesia, [afriani.maifizar@utu.ac.id](mailto:afriani.maifizar@utu.ac.id)

***Abstract***

**Introduction** according to the international Diabetes Federation in the case of diabetes in the world 2018 ; 425 million, prevalance Indonesia 6.9%, North Sumatera 5.3%, and Medan 2.3%. **The Objective** of the research was to analyze the hypertension and HDL which influenced the incidence of kidney failure complication in DM Type II patients at RSUD dr. Pirngadi, Medan. **The Method** was observational analytic with case control design, the sample in the case group were 32 DM Type II patients with kidney failure complication, and in control group were 32 DM Type II patients without kidney failure complication. The data were analyzed by using chi square test, t-independent test, mann-whitney test, and multiple logistic regression analysis, the total of the 64 respondent. **The Result** of multivariate analysis showed that hypertension OR ; 17.845, HDL OR; 7.049. **The Conclusion** it was also found that the factor which the most dominant influence on the incidence of kidney failure complication in DM Type II patients was hypertension at the Population Attributable Risk of 91%. **The Recommended** was the DM Type II patients controlled hypertention and HDL with aplied helth diet,and physical activity to preventiv DM Type II complication kidney failure.

**Keywords: DM Type II, Kidney Failure, Hypertension, HDL**

**PENGARUH HIPERTENSI dan HDL TERHADAP KASUS DM TIPE II**

**KOMPLIKASI GAGAL GINJAL**

**Abstrak**

Latar belakang masalah berdasarkan data kasus dari International Diabetes Federaton (IDF) di Dunia diketahui kasus diabetes 2018: 425 juta, prevalen kasus di Indonesia 6,9%, Sumatera Utara 5,3%, dan Medan 2,3%. Tujuan penelitian adalah menganalisis pengaruh hipertensi dan HDL terhadap kasus DM Tipe II komplikasi gagal ginjal di RSUD dr. Pirngadi, Medan. Metode penelitian adalah analitik observasional dengan desain kasus-kontrol, sampel penlitian terdiri dari 32 sampel kasus pasien DM Tipe II komplikasi gagal ginjal, dan 32 sampel kontrol pasien DM Tipe II tanpa komplikasi gagal ginjal.Data dianalisis dengan menggunakan uji kai-kuadarat, t-independent, mann-whitney, dan multivariat regresi logistik. Hasil penelitian berdasarkan analisis multivariat menunujukan nilai risiko hipertensi OR: 17,845, HDL : 7,049. Kesimpulan penelitian ditemukan bahwa faktor yang palaing dominan berpengaruh terhadap kasus DM Tipe II komplikasi gagagl ginjal adalah hiperetensi dengan diperkuat nilai Population Attributable Risk 91%. Saran yang direkomendasikan kepada pasien adalah untuk mengontrol hipertensi dan HDL dengan menjaga poala makan sehat dan olahraga sehingga dapat mencegah DM Tipe II komplikasi gagal ginjal.

**Kata Kunci : DM Tipe II, Gagal Ginjal, Hipertensi, HDL**

**Introduction**

Diabetes mellitus (DM) is a collection of symptoms that arise in a person caused by an increase in blood glucose levels due to a decrease in progressive insulin secretion against the background of insulin resistance1-5. The 2012 WHO noted that in low and middle income countries more than 80% of deaths were caused by DM. By 2030 it is predicted that more than two-thirds (70%) of the global population will die from non-communicable diseases such as cancer, heart disease, stroke and DM6,7.

DM is the most common cause of kidney failure, almost 44% of cases exist. Even when DM can be controlled, this disease can still cause kidney failure. DM even causes 28.5% retinopathy, and 60% reduction in lower limbs8,9. According to the 2014 International Diabetes Federation (IDF) data in Indonesia there was 5.8% prevalence of DM. 2013 Basic Health Research DM prevalence in Indonesia based on interviews diagnosed by doctors by 1.5%. DM is diagnosed by a doctor or symptom by 2.1%10,11.

The prevalence of DM in Indonesia based on interviews in 2013 was 2.1%. This figure is higher than in 2007 1.1%. A total of 31 provinces (93.9%) showed a significant increase in DM prevalence4. Riskesdas data in 2013 on the prevalence of DM in North Sumatra based on interviews diagnosed by doctors was 1.8%. DM is diagnosed by a doctor or symptom by 2.3%. The prevalence of DM patients in North Sumatra is almost close to the national average. North Sumatra has a prevalence of 5.3%, or only 0.4% below the national average which reached 5.7%. patients who have known that they have DM before are only 26%. While most of those diagnosed with DM or about 74% did not know of suffering from previous DM12.

Based on the preliminary survey conducted at the RSUD. Dr. Pirngadi Medan found the number of cases of diabetes mellitus (DM) with complications of kidney failure in 2012 as many as 20 cases, in 2013 as many as 6 cases, in 2014 as many as 65 cases. Based on the description of the various literature above, it is necessary to do research on cases of DM complications of renal failure in Dr. RSUD Pirngadi Medan. From the background above, the problems that will be studied further in this study are: What are the risk factors that affect DM cases of complications of kidney failure in Dr. RSUD Pirngadi Medan in 2015.

The purpose of this study was to analyze the hypertension and HDL which influenced the incidence of kidney failure complication in DM Type II patients at RSUD dr. Pirngadi, Medan.

**Material and Method**

This research is a case control study. This study was conducted in Dr. Pirngadi Hospital in Medan in 2015. The population of the case was all patients with Type II DM who had complications of kidney failure who visited the RSUD Dr. Pirngadi Medan in 2015.

The control population was that all Type II DM patients had no complications of kidney failure who visited Dr. Pirngadi Medan in 2015.

The case population in this study was all Type II DM patients with complications of kidney failure who visited Dr. Pirngadi Medan as many as 64 people. Case samples are obtained by calculating the sample size using the formula:

Where

Information :

n1 = n2 = Sample size

α = Significance level of 5%, then the value of z = 1.96

zα = Normal deviation value α 5% = 1.96

zβ = Normal deviation value β 20% = 0.842

OR = Odds Ratio

P = Proportion of risk factors

Q = 1-p

The sample size is based on several variables from previous studies according to the following table:

**Table 1. Sample Size Based on Prior Research**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | OR | P | n1=n2 | n+10% | Reference |
| Family history  Sports Practice  Blood Glucose Levels  Systolic Blood Pressure | 6  8  3  14 | 0,001  0,004  0,0001  0,0001 | 13  11  29  8 | 14  12  32  9 | Handayani, 2003  Dewi, 2013  Iseki,2004  Arsono, 2005 |

In the table 1. were based on the results of the calculation above, the maximum sample size of 29 after 10% of exposure is 32 people with Type II DM Complications of Kidney Failure. So that the number of samples for the case group was 32 people with Type II DM Complications of Kidney Failure and the control group 32 people with Type II DM without Complications of Kidney Failure. Comparison of cases with controls was 1: 1 matching by age and sex.

**Result**

**Univariate Analysis**

**Table 2. Frequency Distribution in Dr. Hospital Pirngadi Medan Based on Risk Factors of Type II Diabetes Mellitus Patients**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Changeable Risk Factors** | **DM Type II Complications of Kidney Failure** | | | |
| **Case** | | **Control** | |
| **n** | **%** | **n** | **%** |
| **Average HDL**  Not Good (≤45mg/dl) | 23 | 71,9 | 9 | 28,1 |
| Good (>45mg/dl) | 9 | 28,1 | 23 | 71,9 |
| **Total** | **32** | **100,0** | **32** | **100,0** |
| **Hypertension**  Yes | 25 | 78,1 | 6 | 18,8 |
| No | 7 | 21,9 | 26 | 81,2 |
| **Total** | **32** | **100,0** | **32** | **100,0** |

In the univariate results, In the table 2, The distribution of the average HDL in the highest case group in HDL was not good (≤45mg / dl), the proportion was 71.9%, while the highest control group in HDL is good (> 45mg / dl) the proportion is 71.9%.The highest distribution of hypertension in the case group in those with hypertension was 78.1%, while the highest control group in those who did not have hypertension was 81.2%.

**Bivariate Analysis**

1. **Categorical Data**

**Table 3. Effect of Risk Factors on Type II DM Events Complications of Kidney Failure**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Changeable Risk Factors** | **DM Type II Complications of Kidney Failure** | | | | ***P Value*** | **OR**  **(95% Cl)** |
| **Case** | | **Control** | |
| **n** | **%** | **n** | **%** |
| **Rata-rata HDL**  Not Good (≤45mg/dl) | 23 | 71,9 | 9 | 28,1 | <0,001 | 2,55  (1,53-4,24) |
| Good (>45mg/dl) | 9 | 28,1 | 23 | 71,9 |
| **Total** | **32** | **100,0** | **32** | **100,0** |
| **Hipertensi**  Yes | 25 | 78,1 | 6 | 18,8 | <0,001 | 4,00  (2,30-6,93) |
| No | 7 | 21,9 | 26 | 81,2 |
| **Total** | **32** | **100,0** | **32** | **100,0** |

In Table 3. it can be seen that the Chi-Square test results show that the variables that have an influence on the incidence of Type II DM complications failure kidneys were average HDL (p = <0.001), hypertension (p = <0.001).

**b.** **Numeric Data**

In Table 4, it can be seen that the results of different means show that there are significant differences in mean HDL, systolic and diastolic blood pressure between cases with controls (p <0.05).

**Table 4. Differences in Mean Risk Factors That Can Be Changed by Type II DM Events Complications of Kidney Failure**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Mean** | **P *Value*** |
| HDL (mg/dl)  Kasus  Kontrol  Sistolik (mmHg)  Kasus  Kontrol  Diastolik (mmHg)  Kasus  Kontrol | 44,44  70,19  147,78  129,25  86,00  71,97 | <0,001  <0,001  <0,001 |

**Multivariate Analysis**

In Table 5, the results of multiple logistic regression tests show that HDL averages (p = 0.022), hypertension (p = 0.002 affect the incidence of Type II DM complications of renal failure. The most dominant variable affects the incidence of kidney failure in Type II DM patients in Dr. Pirngadi Hospital in Medan is hypertension with a regression coefficient value of 2.882 and Exp B (OR) 17.845 means that if Type II DM sufferers experience kidney failure 18 times more likely to have hypertension than Type II DM patients who do not experience kidney failure.

**Table 5. Final Results of Multiple Logistic Regression Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **B** | **Sig.** | **Exp B(OR)** | **95%CI** |
| Average HDL | 1,953 | 0,022 | 7,049 | 1,327-37,433 |
| Hypertension | 2,882 | 0.002 | 17,845 | 2,975-107,062 |
| Konstanta | -4,325 | 0,000 | 0,013 |  |
|  |  |  |  |  |

Percentage Correct value obtained at 85.9%, which means that the average variable HDL, hypertension, diet (diet), and duration of suffering from Type II DM explain the effect on the incidence of Type II DM complications of kidney failure in Dr. RSUD. Pirngadi Medan is 85.9%, while the remaining 14.1% is influenced by other factors not included in this research variable.

**PAR (Populatio Attributable Risk)**

Calculating PAR value (Population Attributable Risk) on the most significantly influential variable with the highest OR (Odds Ratio)

Hypertension most influential on the incidence of Type II DM complications of renal failure obtained OR at 17.845 (95% CI = 2.975-107.062) and p at 0.002 statistically significant, then PAR values ​​were:



This means that almost 91% of cases with the incidence of Type II DM complications of kidney failure can be prevented by correcting risk factors, namely hypertension to normal blood pressure.

**Discussion**

Based on the results of bivariate analysis with independent t-test on systolic blood pressure and mann-whitney test on diastolic blood pressure there were significant differences in mean systolic and diastolic blood pressure between Type II DM patients complicating kidney failure (cases) with uncomplicated Type II DM patients kidney failure (control) (p <0.05).

This is in line with the results of the chi-square test where there is an influence between hypertension and the incidence of Type II DM complications of renal failure obtained OR = 4.00 (95% CI = 2.30-6.93), meaning that Type II DM patients who experience failure kidney has a chance of 4.00 times hypertension compared to Type II DM patients who do not experience kidney failure,

In line with the results of multivariate hypertension, the influence of the incidence of Type II DM complicating renal failure was OR = 17,845 (95% CI = 2,975-107,062), meaning that Type II DM patients who had kidney failure had a chance of 17,845 times hypertension compared to Type II DM patients who did not experience kidney failure.

This is also in line with Arsono's research, 2015 in the RSUD Prof. Dr. Margono Soekarjo Purwokerto obtained results that analyzed the influence of hypertension with the incidence of Type II DM complications of renal failure obtained OR = 14,15 means that Type II DM patients who experience kidney failure have a chance of 14.15 times hypertension (systolic blood pressure ≥140mmHg) compared with DM patients II who did not experience kidney failure and statistically explained that there was a significant effect with a value of p <0.0513.

Likewise in the analysis of the influence of hypertension with the incidence of Type II DM complications of renal failure obtained OR = 10.00 means that Type II DM patients who have kidney failure have a chance of 10.00 times hypertension (diastolic blood pressure ≥90mmHg) compared to Type II DM patients who do not experienced kidney failure and statistically explained that there was a significant effect with a value of p <0.0513. Research results are in line by Dewi, 2014 states was threre was influnenced hypertension with diabetes14.

According to research (Zhen,etc, 2017) was Diabetes mellitus and hypertension are major risk factors for chronic kidney injury, together accounting for >70% of end-stage renal disease. In this study, we assessed interactions of hypertension and diabetes in causing kidney dysfunction and injury and the role of endoplasmic reticulum (ER) stress. Hypertension was induced by aorta constriction (AC) between the renal arteries in 6-month old male Goto-Kakizaki (GK) type 2 diabetic and control Wistar rats. Fasting plasma glucose averaged 162±11 and 87±2 mg/dL in GK and Wistar rats, respectively. AC produced hypertension in the right kidney (above AC) and near normal blood pressure (BP) in the left kidney (below AC), with both kidneys exposed to the same levels of glucose, circulating hormones, and neural influences. After 8 wks of AC, BP above the AC (and in the right kidney) increased from 109±1 to 152±5 mmHg in GK rats and from 106±4 to 141±5 mmHg in Wistar rats. The diabetic-hypertensive right kidneys in GK-AC rats had much greater increases in albumin excretion and histological injury compared to left kidneys (diabetes only) of GK rats or right kidneys (hypertension only) of Wistar-AC rats. Marked increases in ER stress and oxidative stress indicators were observed in diabetic-hypertensive kidneys of GK-AC rats. Inhibition of ER stress with tauroursodeoxycholic acid (TUDCA) for 6 wks reduced BP (135±4 vs 151±4 mmHg), albumin excretion, ER and oxidative stress, glomerular injury, while increasing GFR in hypertensive-diabetic kidneys. These results suggest that diabetes and hypertension interact synergistically to promote kidney dysfunction and injury via ER stress15.

Having the highest PAR value of 91%, meaning that almost 91% of cases with the incidence of Type II DM complications of kidney failure can be prevented by improving hypertension to have normal blood pressure

The multivariate results of average HDL have an influence on the incidence of Type II DM complications of renal failure obtained OR = 7.049 (95% CI = 1.327-37,433), meaning that Type II DM patients who experience kidney failure have a chance of 7.049 times the average HDL is not good (≤ 45mg / dl) compared to Type II DM patients who did not experience kidney failure. In line with Antonio's research, 2013 at the Spanish Hospital where p = 0.001 (p <0.05) means that HDL has an influence on the incidence of Type II DM complications of kidney failure.

Has a PAR value of 78%, meaning that nearly 78% of cases with the incidence of Type II DM complications of kidney failure can be prevented by improving the average HDL is not good (≤45mg / dl) to be good (> 45mg / dl).

High Density Lipoprotein (HDL) cholesterol absorbs cholesterol and brings it back to the liver, which flushes from the body. High levels of HDL, or "good" cholesterol, reduce the risk of heart disease, stroke, diabetes, and other diseases, and vice versa16.

According to research (Gourgari, etc, 2019) states that there are HDL influences on diabetes cases with a P value: 0.0001. Research in line (Luo, etc, 2014) states low HDL levels affect the incidence of diabetes with OR (6,818, P = 0.002)17,18.

**Conclusion**

Based on the results of this study, it can be concluded were t here is an influence of Hypertension and HDL on the incidence of Type II DM complications of kidney failure in Dr. RSUD Pirngadi Medan. The most dominant variable influences the incidence of Type II DM complications of kidney failure in Dr. RSUD Pirngadi Medan is hypertension with OR = 17,845 (95% CI = 2,975-107,062). There was Population Attributable Risk (PAR) obtained by 91% of cases with the incidence of Type II DM complications of kidney failure can be prevented by correcting risk factors, namely hypertension.

**Ethical Consideration**

Ethical Consideration Number : 478/V/SP/2015, Subject : approval of the USU Nursing Faculty health research ethics committee, University Of North Sumatera

**References**

1. Fakultas Kedokteran Universitas Indonesia. Komplikasi Diabetes Tipe 2: Pencegahan dan Penanganannya. Jakarta : Penerbit FKUI; 2014 **(Book)**
2. Papadakis M.A, Mcphee S.J. Current Medical Diagnosis and Treatment. USA : McGraw Hill Companies; 2014 **(Translated Book)**
3. Davey P. At a Glance Medicine (terjemah dari judul asli medicine at a glance). Jakarta : Erlangga; 2010 **(Translated Book)**
4. Price S.A, Wilson L.M. Patofisiologi Konsep Klinis Proses-Proses Penyakit, Edisi Keenam. Jakarta: EGC; 2012. **(Translated Book)**
5. Rubenstein D, Wayne D, Bradley J. Lecture Notes: Kedokteran Klinis. Jakarta : Erlangga; 2012. **(Translated Book)**
6. Worl Health Organitation (WHO). Diabetes. Geneva; 2014. **(Article, Researh Report)**
7. Kementerian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia Tahun 2013. Jakarta; 2012. **(Article, Researh Report)**
8. National Institutes of Healths (NIH). Kidney Disease of Diabetes. In:National Institute of Diabetes and Digestive and Kidney Diseases (NIDDKD). USA; 2014. **(Article, Researh Report)**
9. American Diabetes Association (ADA). Statistics About Diabetes. Amerika; 2014. **(Article, Researh Report)**
10. International diabetes Federation (IDF). Indonesia. Belgium; 2014. **(Article, Researh Report)**
11. Kementerian Kesehatan Republik Indonesia. Buletin Jendela dan Data Informasi Kesehatan Penyakit Tidak Menular. Jakarta; 2012. **(Article, Researh Report)**
12. Badan Penelitian dan Pengembangan Kesehatan Dasar Departemen Kesehatan Republik Indonesia. Riset Kesehatan Dasar 2013. Jakarta; 2012. **(Article, Researh Report)**
13. Arsono S. Diabetes Melitus Sebagai Faktor Risiko Gagal Ginjal Terminal, Tesis Program Pasca Sarjana Universitas Diponegoro. Semarang : UNDIP; 2015. (**thesis)**
14. Dewi R.P. Faktor Risiko Perilaku yang Berhubungan dengan Kadar Gula Darah Pada Penderita DM Tipe 2 di RSUD Kabupaten Karanganyer, Skripsi; 2014. (**graduation paper)**
15. Zhen, Wang., etc, 2017. Synergistic Interaction of Hypertension and Diabetes in Promoting Kidney Injury and the Role of Endoplasmic Reticulum Stress. Published in final edited form as: Hypertension. 2017 May ; 69(5): 879–891. doi:10.1161/HYPERTENSIONAHA.116.08560.**(Research Report/ Journal)**
16. Centers for Disease Control and Prevention (CDC). LDL and HDL. Atlanta; 2010. **(Article, Researh Report)**
17. Guargari, Evgenia, etc., 2019. Proteomic alterations of HDL in youth with type 1 diabetes and their associations with glycemic control: a case–control study. Gourgari  et al. Cardiovasc Diabetol (2019) 18:43 <https://doi.org/10.1186/s12933-019-0846-9>. **(Research Report/ Journal)**
18. Lou, Yun., etc, 2014. Low HDL cholesterol is correlated to the acute ischemic stroke with diabetes mellitus. Luo et al. Lipids in Health and Disease 2014, 13:171http://www.lipidworld.com/content/13/1/171. **(Research Report/ Journal)**