Jurnal Epidemiologi Kesehatan Komunitas
6 (1), 2021, 207-212

JEKK

Correlation Between Total Cholesterol Level with Blood Pressure of Hypertensive Patients in Kalidoni, Palembang

Tungki Pratama Umar [*], Mariana [**]

[*]Medical Profession Program Student, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia
[**]Department of Public Health, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia

ABSTRACT

Background: Hypertension is the main problem worldwide. It has strong relationship with other component of metabolic syndrome, namely dyslipidemi. The research objective is to analyze the correlation between total cholesterol level and blood pressure in the hypertensive patient at Kalidoni Primary Health Center, Palembang, Indonesia.

Methods: This was a cross-sectional study involving 82 adult hypertensive patients. Data were collected from the medical record of patients who are visiting Kalidoni Primary Health Center in December 2019-January 2020. Demographic data, blood pressure, and total cholesterol level were gained. Obtained data are analyzed descriptively (frequency distribution) and analytically (correlation using Pearson or Spearman method).

Result: Significant positive correlations were observed between total cholesterol level and systolic blood pressure (r=0.509, p=0.000) in addition to body weight and diastolic blood pressure (r=0.279; p=0.011).

Conclusion: Blood cholesterol level had a significant correlation with moderate strength for determining systolic blood pressure level in hypertensive patients.

Keywords: Total Cholesterol; Blood Pressure; Hypertension.

*Corresponding author, tungkipratama@gmail.com

Introduction

Hypertension is the main problem worldwide. About 7.5 million of all deaths or 12.8% of all mortalities are related to hypertension.[1] Prevalence of hypertension also really eminent with about 1.13 billion cases globally and the majority is happening in low-middle income country.[2] Indonesia, one of the most populated countries in the world is contributing to a big constituent of hypertension worldwide with about 658.201 cases by 2018. Another phenomenon of hypertension in Indonesia is bad compliance to consume antihypertensive drugs (only 58,6%).[3] Hypertension is also a component of metabolic syndrome and has a firm association with other risk factors, including dyslipidemia.[4]

Dyslipidemia, a strong predictor of cardiovascular disease, causing endothelial disruption and loss of vasomotor function, manifested as the systemic elevation of blood pressure.[5] Some studies illustrated abnormal lipid function and hypertension.[6,7] But, other study stated that there is no relationship between dyslipidemia and systolic nor diastolic blood pressure.[8]

In Kalidoni Primary Health Center (Puskesmas), hypertension is on the second tier of disease prevalence, consisting of 6.406 cases according to Kalidoni Primary Health Center Profile in 2019. In this healthcare facility, only 38% of patients are adequately treated according to the minimum care standard that is also oriented to controlled lipid profiles.[9] Giving that phenomenon, we are analyzing the correlation between total cholesterol level and blood pressure in the hypertensive patient at Kalidoni Primary Health Center, Palembang.

Methods

This was an analytical observational study with a cross-sectional design conducted in Palembang, Indonesia from December 2019 through January 2020. Subjects of our study are the medical record of adult patients diagnosed with hypertension who visited Kalidoni Primary Health Care and checking their total cholesterol level. Our studies used consecutive sampling.

Our study was done by data collection of all hypertensive patients who are visiting Kalidoni Primary Health Care Facilities in the study period. From the available medical records, we are stockpiling age, gender, systolic, and diastolic blood pressure measurement, total cholesterol level, body weight, and body height data. Blood pressure was expressed in mmHg, cholesterol level represented with mg/dL, body weight in kilograms (kg) and body height stated in meter (m).

Data were analyzed descriptively to report the frequency distribution of the variable. Statistical analysis was conducted by the assessment of normality using the Kolmogorov-Smirnov test. Correlational analysis was done using Pearson analysis if the data were normally distributed, otherwise, Spearman analysis was conducted. Data analysis is processed with the Statistical Program for Social Sciences (SPSS®) version 25.0. Significance level set at $p<0.05$.

Result

From 105 medical records, only 82 are analyzed further due to incomplete data in 23 medical records. Characteristics of the study subjects are depicted in table 1. From the descriptive analysis, we found that most of our participants are aged between 55-64 years (mean: 58.07 ± 8.88 years), female, mean systolic: 156.51±18.91 mmHg, mean diastolic: 85.43±10.91 mmHg, average total cholesterol: 228.87±43.05 mg/dL, mean body weight, height and body mass index (BMI) are 62.96±10.05 kg, 1.55±0.07 m and 26.25±4.24 kg/m2, respectively.

For the statistical analysis of independent variable correlation with systolic and diastolic blood pressure, the details are outlined in table 2. The correlations between total cholesterol with systolic blood pressure and body weight with diastolic blood pressure are statistically significant although they did not show strong relationship power (moderate for total cholesterol and weak for body weight).

Table 1. Distribution of Frequency for Study Subjects

		Frequency	Percentage
Gender	Female	56	68,3%
	Male	26	31,7%
Age Group	18-24 years	0	0,0%
	25-34 years	1	1,2%
	35-44 years	6	7,3%
	45-54 years	15	18,3%
	55-64 years	43	52,4%
	65-74 years	15	18,3%
	≥ 75 years	2	2,4%
Hypertension Status	Grade I	53	64,6%
	Grade II	25	30,5%
	Grade III	4	4,9%
Total Cholesterol Level*	Normal	24	29,3%
	Hypercholesterolemia	58	70,7%
Body Mass Index Level*	Normal	37	45,1%
	Overweight	14	17,1%
	Obesity	31	37,8%

*****Notes: Distribution is normal accrording to Kolmogorov-Smirnov Test of Normality. For blood pressure, only diastolic component fulfilling the normality criteria.

Table 2. Correlation Analysis between Independent Variable with Systolic and Diastolic Blood Pressure

Age			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	0,162	0,147	0,026
Diastolic	0,188	0,091	0,035
Gender			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	0,075	0,501	0,006
Diastolic	0,108	0,336	0,012
Total Cholesterol			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	0,509	0,000*	0,26
Diastolic	0,077	0,493	0,006
Body Weight			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	0,116	0,299	0,013
Diastolic	0,279	0,011*	0,078
Body height			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	-0,066	0,557	0,004
Diastolic	0,213	0,055	0,045
Body Mass Index			
Blood pressure	Correlation coefficient (r)	Significance (p)	Determination coefficient (r^2)
Systolic	0,144	0,197	0,021
Diastolic	0,158	0,157	0,025

*****Note: Significant value according to Spearman test, $p<0.05$.

Discussion

Our study showed relatively the same demographic characteristics for the majority of gender and age groups as published by Ulfah, Sukandar dan Afiatin in 2017 stating that majority of samples are female (70.1%) and at 60-69 age groups (29.9%).[10] Hypercholesterolemia was found in 70.7% of patients, showing a slightly higher value than National Health and Nutrition Examination Surveys (NHANES) data in South Korea (60,7–64.3%).[11]

For mean age, diastolic blood pressure and body mass index, our study showed relatively same value with Bawazir and Sianipar study (58.07±8.88 vs. 55.13±10.37; 85.43±10.91 vs. 81.71±10.11 and 26.25±4.24 vs. 25.55±3.97, respectively). Otherwise, systolic blood pressure showed relatively high difference (156.51±18.91 vs. 134.13±21.0). It is explained with community diagnosis findings in that area showed that there are many low-educated residents followed with low control of hypertension status and bad lifestyle (including smoking and consuming a high amount of salt).[12] In this study, average cholesterol level, body weight, and body height do not differ significantly with Choudhury, et.al.[13] study in Bangladesh. Observed datas are total cholesterol (228.87±43.05 cm vs. 238.31±3.39 cm), body weight (62.96±10.05 cm vs. 62.32±6.33 cm) and body height (155.06±7.2 cm vs. 155±54 cm).[13]

A significant correlation between total cholesterol and systolic blood pressure was found. It is the same with an earlier study stating that the correlation only happening for systolic blood pressure.[10,14] It is explained with other types of hypertension, isolated systolic hypertension which is happening in 54 of 82 samples (65,85%), but our study did not mention it as a classification. By our model, systolic blood pressure was affected 26% by total cholesterol level.

Out of any other measurement, the researcher found that body weight, but not body mass index showed a significant correlation with diastolic blood pressure. Bodyweight contributing to 7.8% of the diastolic blood pressure value. It is relatively same with Awasthi, et.al[15] in Nepal stating a positive correlation between body weight and blood pressure.

Significance of total cholesterol and systolic blood pressure is based on many mechanisms including atherosclerosis due to lipid accumulation causing structural changes of the blood vessel. It is related to diminished elasticity of the big artery, generally approved as main pathophysiological changes for arterial hypertension in the elderly. Dyslipidemia also responsible for changing nitric oxide-mediated vasomotor activity, hyperinsulinemia (increase circulating catecholamine) causing hypertension.[16,17]

Some mechanisms related to the correlation between body weight and blood pressure. Pathophysiology of this phenomenon mainly related to adiposity role causing up-regulation of the renin-angiotensin-aldosterone axis in addition to water and sodium retention.[18]

Our study still needs some improvement including a cross-sectional design that cannot conclude the definite relationship of risk factor and its role for hypertension state. Some other important data including education, ethnicity, eating pattern, physical activity, drug-consuming compliance, and stress level due to secondary data type. The duration of hypertension also needed to be assessed because it is a potential confounding factor.

Conclusion

The levels of blood cholesterol in hypertensive patients had a significant correlation with moderate intensity to determine the systolic blood pressure levels. Significant correlation with diastolic blood pressure was been found regarding body weight (but not body mass index). This finding is supporting the program to control blood cholesterol level in hyertensive patients.

Acknowledgement

The authors thanks to respondents at Kalidoni Primary Health Center, Palembang.

References

1. World Health Organization. 2019. Raised blood pressure. Global Health Observatory (GHO) data, viewed 15 June 2020, <https://www.who.int/gho/ncd/risk_factors/blood_pressure_prevalence_text/en/>

2. World Health Organization. 2019. Hypertension, viewed 13 June 2020, < who.int/news-room/fact-sheets/detail/hypertension>

3. Badan Penelitian dan Pengembangan Kesehatan. 2019. Laporan Nasional Riskesdas 2018. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan, Jakarta.

4. Lee, S. E., Han, K., Kang, Y. M., Kim, S. O, Cho, Y. K., Ko, K. S., Park, J. Y., Lee, K. U., Koh, E. H. 2018. Trends in the prevalence of metabolic syndrome and its components in South Korea: Findings from the Korean National Health Insurance Service Database (2009–2013). PLoS One. 13(3):e0194490.

5. Wong, N., Lopez, V., Tang, S., Williams, G. 2006. Prevalence, treatment and control of combined hypertension and hypercholesterolemia in adults in the USA. 2006. Am J Cardiol. 98: 204–8.

6. Ademolu, A. 2017. Correlation between Hyperlipidemia and Hypertension, Mean Arterial Pressure, Pulse Pressure among Africans. Endocrinol Metab Int. 5 (6): 00140.

7. Cocci, G., Spannella, F., Giulietti, F., Balietti, P., Landi, L., Cenci, A., Rosettani, G., Sarzani, R. 2017. Dyslipidemia In Hypertensive Patients Undergoing 24-Hours Ambulatory Blood Pressure Monitoring. J Hypertens. 35:e99–e100.

8. Behradmanesh, S., Nasri, P. 2016. Serum cholesterol and LDL-C in association with level of diastolic blood pressure in type 2 diabetic patients. J Ren Inj Prev. 1 (1): 23–6.

9. Puskesmas Kalidoni. 2019. Profil Kesehatan Puskesmas Kalidoni. Puskesmas Kalidoni: Palembang.

10. Ulfah, M., Sukandar, H., Afiatin, A. 2017. Hubungan Kadar Kolesterol Total dengan Tekanan Darah pada Masyarakat Jatinangor. JSK. 3(2):58–64.

11. Brent, M. E. Li, J., Qanungo, S., Wolfman, T. E. 2013. Blood Pressure and Cholesterol Control in Hypertensive Hypercholesterolemic Patients: NHANES 1988–2010. Circulation. 128(1):29–41.

12. Umar, T. P., Salsabila, A., Yuniarti, D., Syarah, S., Syakurah, R. A. 2019 Diagnosis Komunitas Puskesmas Wilayah Kerja Puskesmas Kalidoni Periode 2 Desember 2019-4 Januari 2020. Technical Report.

13. Choudhury, K. N., Mainuddin, A., Wahiduzzaman, M., Islam, S. M. S. 2014. Serum lipid profile and its association with hypertension in Bangladesh. Vasc Heal Risk Manag. 10: 327–32.

14. Sakurai, M., Stamler, J., Miura, K., Brown, I. J., Nakagawa, H., Elliott, P., Ueshima, H., Chan, Q., Tzoulaki, I. Dyer, A. R., Zhao, L., Okayama, A. The INTERMAP Research Group. 2011. Relationship of Dietary Cholesterol to Blood Pressure: The INTERMAP Study. J Hypertens. 29 (2): 222–8.

15. Awasthi, J. R., Uprety, B. N., Mallik, S. L., Pant, P. 2015. The best anthropometric index to access the risk of hypertension in the population of Kavre district, Nepal. Eur J Anat. 19(3):269–75.

16. Freitas, M. P. D., Filho, A. I. de L., Lima-Costa, M. F. 2011. Dyslipidemia and the risk of incident hypertension in a population of community-dwelling Brazilian elderly: the Bambuí cohort study of aging. Cad Saude Publica. 27 (Sup 3.) :S351–9.

17. Yeasmin, N., Akhter, Q. S., Mahmuda, S., Nahar, S., Abira, M., Rahman F, Habib, T. B., Hasan, M., Yeasmin, S. 2019. Association of Serum Triglycerides and Total Cholesterol levels with Hypertension in Adult Female. Bangladesh Crit Care J. 7 (1): 35–9.

18. Sabaka, P., Dukat, A., Gajdosik, J., Bendzala, M., Caprnda, M., Simko, F. 2017. The efects of body weight loss and gain on arterial hypertension control: an observational prospective study. Eur J Med Res. 22 (43):1–7.