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Comparison of Blood Pressure and Blood Glucose Level Among Elderly with Hypertension and/or Diabetes Mellitus in Bangkok and Surabaya

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Ni Putu Wulan Purnama Sari

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Comparison of Blood Pressure and Blood Glucose Level Among Elderlywith Hypertension and/or Diabetes Mellitus in Bangkok and Surabaya

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Comparison of blood pressure and blood glucose level among elderly with non-communicable disease

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ABSTRACT

Due to increasing age, elderly are prone to non-communicable diseases (NCD), such as hypertension (HT) and diabetes mellitus (DM). Blood pressure (BP) and blood glucose level (BGL) are vital to be monitored. This study aimed to compare and analyze the differences of BP and BGL among elderly with HT and/or DM. This cross-sectional study involved 100 and 96 elderly with HT and/or DM in communities of Bangkok and Surabaya respectively (n=196). Instruments used were demography questionnaire, sphygmomanometer, and glucometer. Test of one-way ANOVA, LSD, Kruskal-Wallis, and Mann-Whitney U were used for data analysis ($\alpha<.05$). There was a significant difference of systolic and diastolic BP found between groups (p=.000 and p=.011 respectively), but no difference found between the groups of HT and DM&HT (p=.657 and p=.330 respectively). There was a significant difference of BGL found between groups (p=.002), but no difference found between the groups of HT and DM (p=.075), and between the groups of DM and DM&HT (p=.066). BP is significantly different between groups of HT and DM, but BGL is similar. Risk of HT is very high in elderly with DM. Elderly with DM&HT has high BP and BGL similarly to those with single disease of HT or DM.

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1. INTRODUCTION

Every individual will experience and face the aging process in the course of his life, and this is a natural process that cannot be avoided. Being elderly is a process that takes place in life, means someone has gone through the stages of life: neonatal, toddler, pre-school, school, adolescent, adult, and elderly. This different stage of life begins both biologically and psychologically [1]. In the world, people who aged more than 60 years old was amounted to 13.4% of the whole human population in 2013, and this percentage was estimated to be doubled up to 25.3% in 2050, in which 8% of these elderly people live in Asia [2].

Gradually, the elderly will experience changes in the ability of various organs' functions and body systems naturally/physiologically. Due to biological changes, elderly will face many problems physically, such as the occurence of chronic illness or well-known as NCD. NCD is not passed from person to person; it is long of duration and generally slow in progression. The four main types of NCD are cardiovascular disease (e.g. hypertension/HT), cancer, chronic respiratory disease, and diabetes mellitus (DM). 80% of all NCD deaths occur in low- and middle-income countries. Almost three quarters of NCD deaths (28 million) occur in low- and middle-income countries. 16 million NCD deaths occur before the age of 70; 82% of these "premature" deaths occurred in low- and middle-income countries [3].

In Indonesia, the amount of elderly people was around 24.9 million or 8.9% in 2013, and it was estimated to be increased up to 29.8 million or 21.4%. Among all the provinces in Indonesia, Province of Each Java, in which its capital is Surabaya, has sat in the 2nd rank in the country as the highest elderly population with 10.4% of the population. There was an increase in number of elderly with HT up to 50% in 2014 nationally [4]. Number of HT prevalence in 2016 as many as 10.43% in Surabaya only [5]. Morbidity rate of elderly in 2015 was 28.62%, meaning there were 28 sick elderly every 100 elderly population, in which HT was the highest NCD found in elderly [6]. Regarding DM, Indonesia is one of the top ten countries with highest DM prevalence. In 2000, people with DM amounted to 8,426,000, and WHO predicted that in 2030 this number will increase up to 21,257,000. An epidemiological study conducted in Indonesia showed that DM prevalence was 1.5 up to 2.3% in people aged more than 15 years old, and DM prevalence was 14.7% and 7.2% in urban and rural area respectively [7].

Thailand began to become an elderly society in 2010, and then elderly claimed 15.3% of total population in 2014. Prevalence of HT is high, particularly in urban areas, but many individuals are not aware that this problem exists. Many have a high cholesterol level. While considerable gains have been made against communicable diseases, there has been a steady rise in NCD. Among the top ten conditions in the disease burden ranking in Thailand, nine are NCDs. In 2009, HT and DM prevalence per-100,000 population were 981 and 736 respectively. Risk factors for NCD such as HT and DM have more than tripled over the last two decades. In 2011, diseases of circulatory system and diseases of endocrine, nutritional, and metabolic were being the two of the top ten leading causes of hospital deaths by 68.8 and 13.8 per-100,000 population respectively [8].

The incidence of elderly with HT is caused by many factors that are closely related to the natural aging process. Some studies concluded that age is also one factor in the occurrence of HT because the increased age of a person will increase the risk of HT. In elderly, structural and functional changes occur in the peripheral vessel system resulted in changes in BP. These changes include atherosclerosis, loss of elasticity of connective tissue, and a decrease in relaxation of smooth muscle of blood vessels which in turn decreases the ability of distention and tensile strength of blood vessels [9]. Complications will also occur in people with HT, such as coronary heart disease, heart failure, brain blood vessel damage, and kidney failure [10].

Category of BP based on the New ACC/AHA Blood Pressure Guidelines which consists of: 1) normal = less than 120/80 mmHg, 2) elevated = systolic between 120-129 mmHg and diastolic less than 80 mmHg, 3) stage 1 = systolic between 130-139 mmHg or diastolic between 80-89 mmHg, 4) stage 2 = systolic at least 140 mmHg or diastolic at least 90 mmHg, and 5) hypertensive crisis = systolic over 180 mmHg and/or diastolic over 120 mmHg [11]. HT begins from stage 1 in which systolic BP between 130-139 mmHg or diastolic BP between 80-89 mmHg. The incidence of elderly with DM, especially type 2, is caused by various factors. Generally, the age of more than 40 years old has higher potency to develop DM, added by a family history of DM [9]. DM risk increases together with the increase of age and body weight, especially obesity (found in 80-90% patients). In DM type 2 (80-90% of cases), the pancreas still produce enough insulin (sometimes more than normal), but the body develops resistance due to various factors related to unhealthy life style, such as lack of exercise and imbalance diet pattern [12-13].

Based on PERKENI consensus, normal value of BGL if measured by using capillary blood as speciment is less than 200 mg/dL (without fasting) [14]. Therefore, the category of BGL was hyperglycemia = ≥ 200 mg/dL, euglycemia = 71-199 mg/dL, and hypoglycemia = ≤ 70 mg/dL. DM often associated with hyperglycemia in which BGL ≥ 200 mg/dL. This study aimed to compare and analyze the differences of BP and BGL among elderly with HT and/or DM in Bangkok and Surabaya. Elderly with DM potentially develop HT during the disease progression. HT and/or DM share some similar potency of having disease complications, such as coronary heart disease, heart failure, brain blood vessel damage (stroke), kidney failure, etc. The result of this study may be beneficial for monitoring the physical condition of elderly with HT and/or DM in community context, as well as for early detection of disease complication, especially from DM becoming HT or DM&HT.

2. RESEARCH METHOD

This was a Cross-sectional study involving 196 elderly with DM and/or HT in communities in Surabaya and Bangkok. There were 96 and 100 cases compiled from Surabaya and Bangkok respectively. In Bangkok, there were five communities used as the study sites. In Surabaya, there were three communities used as study sites: RW V, VI, and VII in the district of Mojo. Sample distribution between two sites is presented in Table 1.

Table 1. Sample distribution

Case	Bangkok	Surabaya	Total
DM	30	30	60
HT	35	33	68
DM&HT	35	33	68
Total	100	96	196

Sample was chosen by criteria then totally included in the study (total sampling). Inclusion criteria consist of (1) elderly who are willing to participate in the study, and (2) consume medication from medical doctor to treat the disease. Exclusion criteria were cannot communicate using Pasa Thai or Bahasa Indonesia. Sample then divided into three groups based on the cases, namely groups of DM, HT, and DM&HT. Variables were systolic and diastolic BP, and BGL which were measured by calibrated sphygmomanometer and glucometer. Demography questionnaire was made to collect the data of respondents' characteristic. Test of one-way ANOVA, Least Significant Difference (LSD), Kruskal-Wallis, and Mann-Whitney U were used for data analysis ($\alpha<.05$).

In this study, there were some confounding variables identified which can interfere the level of BP and BGL in elderly with DM and/or HT, such as: age, diet, exercise, stress, sleep, drugs consumed, and co-morbidity. Age was conditioned in elderly population only to minimize the potential differences existed in various age groups. The factors of diet and exercise was not strictly conditioned because it was very hard to do so, therefore this become our study limitations. Prior to data collection, we assessed respondent's stress level by using instrument of SPST-20, and we excluded respondents with severe stress level. We also excluded respondents with insomnia, heart disease, renal disease, and other serious co-morbidity. As for drug consumption, we only included respondents who follow regiments from medical doctor regularly. Ethical clearance was issued by Ethical Committee of Saint Louis College (SLC), Bangkok, Thailand (November, 2016), with certificate number: E.038/2559. There was no conflict of interest between authors and study funder regarding this study and publication.

3. RESULTS AND DISCUSSION

In total, the study respondents composed of 15.82% male and 84.18% female. Age range was 60 – 78 years old. The educational background of sample in Bangkok was mostly primary school (53%), while in Surabaya was mostly secondary school (64.58%). The income of sample in Bangkok was mostly 43% at THB 2000-6000 per-month (43%), while in Surabaya was mostly less than IDR 800 thousand per month (53.13%). In Bangkok, most respondents has relative who suffered from DM/HT (66%), while in Surabaya no family background was reported (69.79%). Table 2 presents the demography characteristic of respondents.

In total (n=196), mostly we found stage 2 of HT (44.39%) but Mean value of BP was higher in Bangkok. Mean value of BP in Surabaya is considered as stage 1 of HT. The data of systolic BP was more various in Surabaya, but the data of diastolic BP was more various in Bangkok (based on SD value). Table 3 presents the comparison of BP between two study sites. In total (n=196), mostly we found euglycemia condition (81.63%), and the Mean value of BGL was also considered as euglycemia in both sites. The data of BGL was more various in Bangkok (based on SD value). Table 4 presents the results of LSD test representing the comparison of BGL between two study sites.

Based on the result of Kolmogorov-Smirnov test, we found that only the data of systolic BP which was normally distributed (p=.105), therefore the test of one-way ANOVA was used for analyzing the differences between three groups of samples. Results showed that there was a significant difference of systolic BP found between groups (p=.000). LSD test then was used for finding which groups determined this difference. It was showed that systolic BP was significantly different between the groups of HT and DM (p=.000) and between the groups of DM and DM&HT (p=.000), but no difference found between the groups of HT and DM&HT (p=.657). It means systolic BP was not much different between the elderly with single disease of HT and those who have more complicated NCD like DM&HT. As for the elderly with single disease of DM, it was expected to find their systolic BP was very different from the other groups because potentially no complications of elevated systolic BP existed at the moment.

Based on the results of Kolmogorov-Smirnov test, we found that the data of diastolic BP was not normally distributed (p=.003), therefore the nonparametric test of Kruskal-Wallis was used for analyzing the differences between three groups of samples. Results showed that there was a significant difference of diastolic BP found between groups (p=.011). Mann-Whitney U test then was used for finding which groups determined this difference. It was showed that diastolic BP was significantly different between the groups of HT and DM (p=.004) and between the groups of DM and DM&HT (p=.033), but no difference found

between the groups of HT and DM&HT (p=.330). It means diastolic BP was not much different between the elderly with single disease of HT and those who have more complicated NCD like DM&HT. As for the elderly with single disease of DM, it was expected to find their diastolic BP was very different from the other groups because potentially no complications of elevated diastolic BP existed at the moment. Table 5 presents the results of Mann-Whitney U test for diastolic BP in details.

Table 2. Demography characteristic

Characteristic	Bangkok (100)		Surabaya (96)	
	n	%	n	%
1. Sex				
a. Male	20	20	11	11.45
b. Female	80	80	85	88.54
2. Age (years old)				
a. 60-69	48	48	75	78.13
b. >70	52	52	21	21.87
3. Education				
a. Primary school	53	53	25	26.04
b. Secondary school	25	25	62	64.58
c. Bachelor degree	8	8	9	9.38
d. No study	14	14	0	0
4. Occupation				
a. Farmer	1	1	0	0
b. Businessman	10	10	12	12.50
c. Government officer	2	2	1	1.04
d. Other (retire, housewife)	87	87	83	86.46
5. Monthly income				
a. THB <2,000 (IDR <800,000)	18	18	51	53.13
b. THB 2,000-6,000 (IDR 800,000-2.4 million)	43	43	31	32.29
c. THB 6,000-10,000 (IDR 2.41-4 million)	19	19	10	10.42
d. THB >10,000 (IDR >4 million)	20	20	4	4.17
6. Family background of HT/DM				
a. Yes	66	66	29	30.21
b. No	34	34	67	69.79

Table 3. Comparison of BGL

Category	Bangkok (100)		Surabaya (96)	
	n	%	n	%
Hyperglycemia	12	12	21	21.88
Euglycemia	86	86	74	77.08
Hypoglycemia	2	2	1	1.04
Mean	155.62		137.90	
SD	65.71		49.34	

Table 4. Results of LSD test

Multiple Comparisons

Dependent Variable: systolic BP

LSD

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HT	DM	17.86667*	3.45265	.000	11.0569	24.6764
	DM&HT	1.48529	3.34301	.657	-5.1082	8.0788
DM	HT	-17.86667*	3.45265	.000	-24.6764	-11.0569
	DM&HT	-16.38137*	3.45265	.000	-23.1911	-9.5716
DM&HT	HT	-1.48529	3.34301	.657	-8.0788	5.1082
	DM	16.38137*	3.45265	.000	9.5716	23.1911

*. The mean difference is significant at the 0.05 level.

Table 5. Results of Mann-Whitney U test (diastolic BP)

(I) group	(J) group	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
HT	DM	1447.000	3277.000	-2.861	.004*
	DM&HT	2089.500	4435.500	-.973	.330
DM	HT	1447.000	3277.000	-2.861	.004*
	DM&HT	1596.000	3426.000	-2.133	.033*
DM&HT	HT	2089.500	4435.500	-.973	.330
	DM	1596.000	3426.000	-2.133	.033*

*. The difference is significant at the 0.05 level.

Based on the results of Kolmogorov-Smirnov test, we found that the data of BGL was not normally distributed (p=.000), therefore the nonparametric test of Kruskal-Wallis was used for analyzing the differences between three groups of samples. Results showed that there was a significant difference of BGL found between groups (p=.002). Mann-Whitney U test then was used for finding which groups determined this difference. It was showed that BGL was significantly different between the groups of HT and DM&HT (p=.000), but no difference found between the groups of HT and DM (p=.075) and between the groups of DM and DM&HT (p=.066). It means BGL was not much different between the elderly with single disease of DM and those who have more complicated NCD like DM&HT. As for the elderly with single disease of HT, it was expected to find their BGL was very different from the other groups because potentially no metabolic disorder existed at the moment. Table 6 presents the results of Mann-Whitney U test for BGL in details.

Table 6. Results of Mann-Whitney U test (BGL)

(I) group	(J) group	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
HT	DM	1667.500	4013.500	-1.779	.075
	DM&HT	1500.000	3846.000	-3.535	.000*
DM	HT	1667.500	4013.500	-1.779	.075
	DM&HT	1655.000	3485.000	-1.839	.066
DM&HT	HT	1500.000	3846.000	-3.535	.000*
	DM	1655.000	3485.000	-1.839	.066

*. The difference is significant at the 0.05 level.

In elderly who are living with HT and/or DM, physical parameter like BP and BGL could be good indicators for monitoring elderly's health status. Results showed that there was a significant difference of systolic and diastolic BP found between groups (p=.000 and p=.011 respectively), but no difference found between the groups of HT and DM&HT (p=.657 and p=.330 respectively). There was a significant difference of BGL found between groups (p=.002), but no difference found between the groups of HT and DM (p=.075) and between the groups of DM and DM&HT (p=.066).

This study finding indicate that whether the elderly has a single disease of HT or DM, in the end his BP and BGL are not significantly different with those who has more complicated disease like DM&HT. The more surprising fact is that we found the BGL between elderly with HT or DM was not significantly different. Theoretically, HT and DM are both the components of metabolic syndrome. DM could be resulted in HT as its complication during the disease progression, but not the opposite. This study results revealed that the risk of being HT for elderly with DM is extremely high. Once HT coexistent with DM, both BP and BGL are not significantly different with those who have a single disease only, and vice versa.

This study finding were supported by a prospective diabetes study in United Kingdom (UK) towards 1,148 patients which showed that HT was very common in people with Type 2 DM; BP lowering could show dramatic benefits in reducing the risk of major macrovascular and microvascular complications [15]. HT in DM cases is a prevalent risk factor and associated with increased risk for a number of DM complications, such as cardiovascular disease (CVD). HT increases the cardiovascular risk in diabetic patients by 2–3-fold [16]. This study results were also supported by a study of Chen, et al., towards 1,145 Framingham subjects who were newly diagnosed with DM [17]. They found that among all subjects who did not have a previous history of cardiovascular events, 58% had HT at the time that DM was diagnosed. During 4,

There were 154 person-years of follow-up, 125 died, and 204 experienced a cardiovascular event. Framingham participants with HT at the time of DM diagnosis exhibited higher rates of all-cause mortality (32 versus 20 per 1,000 person-years; P<0.001) and cardiovascular events (52 versus 31 per 1,000 person-years; P<0.001) compared with normotensive subjects with DM. After adjustment for demographic and clinical covariates, HT was associated with a 72% increase in the risk of all-cause death and a 57% increase in the risk of any cardiovascular event in individuals with DM. The population-attributable risk from HT in

individuals with DM was 30% for all-cause death and 25% for any cardiovascular event (increasing to 44% and 41%, respectively, if the 110 normotensive subjects who developed HT during follow-up were excluded from the analysis). In comparison, after adjustment for concurrent HT, the population-attributable risk from DM in Framingham subjects was 7% for all-cause mortality and 9% for any cardiovascular disease event. Although DM is associated with increased risks of death and cardiovascular events in Framingham subjects, much of this excess risk is attributable to coexistent HT.

Long & Dagoo-Jack stated that up to 75% of adults with DM also have HT, and patients with HT alone often show evidence of insulin resistance [18]. Thus, HT and DM are common, intertwined conditions that share a significant overlap in underlying risk factors (including ethnicity, familial, dyslipidemia, and lifestyle determinants) and complications of microvascular and macrovascular disorders. The macrovascular complications, which are well recognized in patients with longstanding DM or HT, include coronary artery disease, myocardial infarction, stroke, congestive heart failure, and peripheral vascular disease. Although microvascular complications (retinopathy, nephropathy, and neuropathy) are conventionally linked to hyperglycemia, studies have shown that HT constitutes an important risk factor, especially for nephropathy. The familial predisposition to DM and HT appears to be polygenic in origin. On the other hand, the shared lifestyle factors in the etiology of HT and DM provide ample opportunity for nonpharmacologic intervention.

As a comparison to younger age groups, we analyzed a study of TODAY Study Group [19]. They conducted a cohort study of 699 adolescents with less than two years duration of type 2 DM, body mass index (BMI) ≥85%, HbA1C ≤8% on metformin therapy, controlled BP, and calculated creatinine clearance >70 mL/min, who were then randomized to metformin, metformin plus rosiglitazone, or metformin plus intensive lifestyle intervention. Primary study outcome was loss of glycemic control for six months or sustained metabolic decompensation requiring insulin. HT and microalbuminuria were managed aggressively with standardized therapy to maintain BP <130/80 or <95th percentile for age, sex, and height and microalbuminuria <30 μg/mg. Results showed that 45.6% respondents reached primary study outcomes, and 11.6% were hypertensive at baseline and 33.8% by the end of study (average follow-up 3.9 years). They found that male sex and higher BMI significantly increased the risk for HT.

A systematic literature review of Colosia, et al., towards 77 articles provided prevalence rates for HT and/or obesity specifically in adults with type 2 DM showed that 61studies reported HT prevalence, 44 reported obesity prevalence, and 12 reported the prevalence of HT with obesity [20]. The continental regions with the most observational studies of HT or obesity prevalence were Europe (n = 30) and Asia (n = 26). HT rates typically were high in all regions; most studies presented rates above 50%, and many presented rates above 75%. Obesity rates exceeded 30% in 38 of 44 studies and 50% in 14 of 44 studies, especially those assessing central obesity (based on waist circumference). Among obese adults, HT rates were at or above 70% in Asia and above 80% in Europe; rates were lower in North and South America but still above 30%. Around the world, HT and obesity, separately or together, are common comorbidities in adults with type 2 DM.

Also in 2013, Matsuda & Shimomura conducted a study to link obesity and increased oxidative stress [21]. Obesity, especially of the abdominal type, is a health problem that constitutes metabolic syndrome and increases the incidence of various diseases, including DM, HT, dyslipidemia, atherosclerosis, and cancer. Various mechanisms linking obesity to these associated diseases have been postulated. One candidate is oxidative stress, which has been implicated in vascular complications of DM and in pancreatic β-cell failure in DM. Notably, obese people without DM also display elevated levels of systemic oxidative stress. In addition, levels of oxidative stress are increased in the adipose tissue in obese mice. Treating obese mice with antioxidant agents attenuates the development of DM. In 3T3-L1 adipocytes, increases in ROS occur with lipid accumulation; the addition of free fatty acids elevates ROS generation further. Thus, adipose tissue represents an important source of ROS; ROS may contribute to the development of obesity-associated insulin resistance and type 2 DM. Moreover, the levels of oxidative stress present in several other types of cells or tissues, including those in the brain, arterial walls, and tumors, have been implicated in the pathogenesis associated with HT, atherosclerosis, and cancer. The increased levels of systemic oxidative stress that occur in obesity may contribute to the obesity-associated development of these diseases.

Oxidative stress may play an important intermediary role in the pathogenesis of DM complications. As the evidence, a study of Pan, et al., aimed at assessing the oxidative stress status in people with DM and diabetic nephropathy in which the study group comprised 40 control subjects, 40 type 2 DM patients without complications, and 37 diabetic nephropathies, found that compared with control subjects, superoxide dismutase, glutathione peroxidase, catalase, vitamin C were decreased ($P < 0.01$) [22]. There was a significant increase in serum malondialdehyde (MDA), conjugated diene (CD), advanced oxidation protein products (AOPP), protein carbonyl (PC) and 8-hydroxy-2′-deoxyguanosine (8-OHdG) in DM patients when compared with normal subjects ($P < 0.01$). Moreover, these indexes were much higher in diabetic nephropathy than that of DM patients without vascular complications ($P < 0.05$, $P < 0.01$). There was a

significant correlation between the serum glucose levels and PC, 8-OHdG (P< 0.05, P< 0.01). There were highly significant positive correlation of CD and MDA, AOPP and PC (P< 0.01). Plasma AOPP levels had a significant correlation with PC levels (P< 0.01). These findings suggested that DM patients have more severe oxidative stress than normal persons and higher oxidative stress in diabetic nephropathy than those in DM patients without complications.

Oxidative stress plays a pivotal role in the development of DM complications, both microvascular and cardiovascular. The metabolic abnormalities of DM cause mitochondrial superoxide overproduction in endothelial cells of both large and small vessels, as well as in the myocardium. This increased superoxide production causes the activation of five major pathways involved in the pathogenesis of complications: 1) polyol pathway flux, 2) increased formation of AGEs (advanced glycation end products), 3) increased expression of the receptor for AGEs and its activating ligands, 4) activation of protein kinase C isoforms, and 5) overactivity of the hexosamine pathway. It also directly inactivates two critical antiatherosclerotic enzymes, endothelial nitric oxide (NO) synthase and prostacyclin synthase. Through these pathways, increased intracellular reactive oxygen species (ROS) cause defective angiogenesis in response to ischemia, activate a number of proinflammatory pathways, and cause long-lasting epigenetic changes that drive persistent expression of proinflammatory genes after glycemia is normalized ("hyperglycemic memory"). Atherosclerosis and cardiomyopathy in type 2 DM are caused in part by pathway-selective insulin resistance, which increases mitochondrial ROS production from free fatty acids and by inactivation of antiatherosclerosis enzymes by ROS [23].

A year after, Folli, et al., added some explanations to the above mentioned five pathways [24]. The increased oxidative stress in subjects with type 2 DM is a consequence of several abnormalities, including hyperglycemia, insulin resistance, hyperinsulinemia, and dyslipidemia, each of which contributes to mitochondrial superoxide overproduction in endothelial cells of large and small vessels as well as the myocardium. Furthermore, the effects of oxidative stress in individuals with type 2 DM are compounded by the inactivation of two critical anti-atherosclerotic enzymes: endothelial nitric oxide synthase and prostacyclin synthase. Of interest, the results of clinical trials in patients with type 2 DM in whom intensive management of all the components of the metabolic syndrome (hyperglycemia, hypercholesterolemia, and essential HT) was attempted (with agents that exert a beneficial effect on serum glucose, serum lipid concentrations, and BP respectively) showed a decrease in adverse cardiovascular end points.

The internationally accepted definition of HT in people with DM is now 130/80 mmHg and this level should be the target for all those on antihypertensive therapy [16]. A study towards 4,733 people with type 2 DM showed that in patients with type 2 DM who were at high risk for cardiovascular events, targeting a systolic BP of less than 120 mmHg, as compared with less than 140 mmHg, did not reduce the rate of a composite outcome of fatal and nonfatal major cardiovascular events [25]. Six years after, we found that the current treatment goal changes into <140/85–90 mmHg in most patients, but <130/80 mmHg in patients with macroalbuminuria as a sign of diabetic nephropathy [26].

Modern guidelines now recommend a structured program for the screening, diagnosis, and treatment of HT in DM. The current treatment goal is <140/85–90 mmHg in most patients, but <130/80 mmHg in patients with macroalbuminuria as a sign of diabetic nephropathy. Most antihypertensive drugs can be used to achieve this BP control, especially in combination treatment [26]. Most patients will require three or more drugs to achieve target BP; agents which block the renin angiotesin system, calcium channel blockers or diuretics are first line [16]. All respondents in this study have consumed antihypertensive drugs for some period of time, but their adherence to treatment was not closely monitored. Adherence differed little across elderly age groups. Adherence to antihypertensive drugs is not linked with reduced BP in patients with DM who are at least 85 years or with multiple comorbidities [27].

Aside from the use of antihypertensive drugs to treat HT in DM patients, diet and lifestyle interventions can also have a significant impact on BP, and these should be recommended as the first-line therapy [16]. As the evidence, results of a randomized crossover clinical trial towards 31 people with type 2 DM in which they followed the eating/diet pattern of DASH (Dietary Approaches to Stop Hypertension) for eight weeks showed that in the end of study the fasting BGL, A1C, systolic and diastolic BP decreased significantly, as well as HDL and LDL cholesterol levels [28].

An interesting study towards 8,494 people with DM concluded that in relation to mortality or macrovascular events, BP monitoring/control was more important than intensive glycemic control. Between-group differences in BP and glycated hemoglobin levels during the trial were no longer evident by the first post-trial visit. The reductions in the risk of death from any cause and of death from cardiovascular causes that had been observed in the group receiving active BP–lowering treatment during the trial were attenuated but significant at the end of the post-trial follow-up. No differences were observed during follow-up in the risk of death from any cause or major macrovascular events between the intensive-glucose-control group and the standard-glucose-control group [29].

In elderly with DM, we found the risk of HT complication was extremely high. Similar findings were also found in worldwide studies. HT was potentially coexistent with DM in the initial DM diagnosis. Both HT and DM are components of metabolic syndrome. The incidence of HT in people with DM was explained by various pathways. Management of people with DM should emphasize more in BP control, together with glycemic control. Dietary management and healthy life style should be the first line of antihypertensive therapy in people with DM, followed by antihypertensive drugs. BP and BGL controls in people with DM are important for reducing mortality and cardiovascular complications, both macro and microvascular.

4. CONCLUSION

Blood pressure is significantly different between the single disease group of HT and DM in term of systole and diastole, especially in elderly, but BGL is similar. The risk of being HT for elderly with DM is extremely high. Elderly with DM&HT have high BP and BGL similarly to those with single disease of HT or DM. This study finding indicate that whether the elderly has a single disease of HT or DM, in the end his BP and BGL are not significantly different with those who has more complicated disease like DM&HT. Once HT coexistent with DM, both BP and BGL are not significantly different with those who have a single disease only, and vice versa.

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