ORIGINAL ARTICLE

Patients' blood pressure control and doctors' adherence to hypertension clinical practice guideline in managing patients at health clinics in Kuala Muda district, Kedah

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ABSTRACT

Background: Blood pressure (BP) control among Malaysian is poor and doctor's adherence to clinical practice guideline (CPG) has been a well-known factor that may improve it. This study was designed to evaluate patients' BP control, doctors' adherence to the latest hypertension CPG and their association. Factors associated with BP control and CPG adherence was also examined.

Methods: A cross-sectional study was conducted in Kuala Muda district's health clinics. 331 medical records were selected using stratified random sampling and standard proforma was used for data collection. The latest edition of the Malaysian CPG on hypertension was employed to define related variables. Results: A total of 160 patients (48.3%) had controlled BP and it was significantly associated with patients' age (adjusted Odds Ratio, aOR= 1.03, 95% CI: 1.004, 1.05, p= 0.016) and systolic BP at presentation (aOR= 0.95, 95% CI: 0.93, 0.96, p< 0.001). About 60.7% of the medical records showed doctor's good level of CPG adherence. This adherence has significant association with presence of chronic kidney disease (aOR= 0.51, 95% CI: 0.31, 0.85, p= 0.007) and cardiovascular disease (aOR= 2.68, 95% CI: 1.04, 6.95, p= 0.030) in the patients and physicians' treatment intensification (aOR= 2.00, 95% CI: 1.26, 3.19, p= 0.009). However, no association was found between BP control and CPG adherence.

Conclusion: Hypertension control in this study was poor and the prevalence of physicians with good level of CPG adherence was slightly above average. These findings are important for relevant stakeholders to strategise an action plan to improve hypertension management outcome.

KEY WORDS:
Blood pressure control; hypertension; guidelines; adherence

INTRODUCTION

In 2008, the prevalence of hypertension worldwide was estimated to be 40% which was a drastic increment from 600 million cases in the 80's to one billion cases.[1] The situation in Malaysia did not differ much as our latest National Health and Morbidity Survey (NHMS), 2015 showed prevalence of hypertension at 30.3% for patient 18 years and older.[2] From the same survey, primary care was noted to be the key player in managing hypertension as 77.3% of hypertensive patients were managed at that level in both private and government facilities. However, despite increasing standard and accessibility to primary healthcare service throughout the years, blood pressure (BP) control among hypertensive patients in Malaysia remained suboptimal which ranged from 26.8% to 48.5%.[3-5]

Many studies had been conducted in the past to explore the causes but majority of them emphasised on the patient's factors such as socio-demographic, medical profile and treatment compliance.[3,5-7] These factors were inconsistent and varied from study to study depending on population selected thus inferred that repeating the same study with different population will never be redundant and may help to discover new associated factors for hypertension control.

Other than patient's factor, physician's factor also played an equally important role in determining the outcome of hypertension treatment whereby adherence to clinical practice guidelines (CPG) was noted to be of utmost importance.[7] This was substantiated by few studies which reported positive association between BP control and guideline adherent prescriptions.[8,9] However, study on association between overall CPG adherence and BP control was non-existence.

Few methods can be instituted to assess physician's adherence to guideline such as auditing patient's medical record, prescription slips and administering questionnaire to them. However, auditing medical records and prescriptions were more commonly used methods in our local setting as discussed from here on. Studies which used prescription data by Abdulameer et al. reported a high adherence rate of 85.3% while contradicting result by Ramli et al. noted prescribing pattern not adherence to latest evidence and guideline.[10,11] However, to decide a doctor's adherence to CPG is not merely towards pharmacological treatment but also inclusive of cardiovascular risk assessments using history taking, physical examinations and investigations. Our latest hypertension CPG stated that doctors' adherence towards cardiovascular risk assessments was low as 54% of patients did not complete

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such assessment and this statement concurred with overseas studies from Kenya and South Africa.[12-14] Contrary to these results, Tong et al. reported not more than 80% of medical records documented clinical and laboratory assessments required by the previous edition (3rd edition) of Malaysia hypertension CPG.[15]

However, all the above mentioned studies were done to assess guideline adherent to risk assessment or pharmacological treatment per se and studies considering overall guideline adherence was scarce. We were only able to find one such study done in Iowa, United States (U.S.), looking at adherence to The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatmenmt of High Blood Pressure (JNC 7) recommendations that included risk assessment, management and follow up which the authors reported mean overall guideline adherence of 53.5%.[16]

After considering the inadequacy of our current knowledge as mentioned above, this study was designed to evaluate patients' BP control, doctors' adherence to latest hypertension CPG (risk assessment and treatment) and their association in patients treated in Kuala Muda district's health clinics. Concurrently, factors associated with BP control and guideline adherence were also examined.

MATERIALS AND METHODS

Background place of study

Kedah is one of the northern states in peninsular Malaysia and Kuala Muda is the second largest district after Kota Setar. There are seven health clinics in this district and managed by Kula Muda health office.

Study design

This was a cross-sectional study done from April to May 2015 using medical records review.

Population and selection criteria

Source population in our study was all hypertensive patients diagnosed and registered into the district hypertension registry by all the seven health clinics. Inclusion criteria were those diagnosed to have hypertension from January 2014 onwards, had at least six month follow up on the date of data collection, age 18 years and above and currently on pharmacological treatment. Patients who defaulted follow up after the initial diagnosis were excluded from this study even though they were listed in the hypertension registry. Selection of cases diagnosed from January 2014 onwards was due to use of latest Malaysia hypertension CPG (4th edition) as a guide for operational definition. This CPG was released in year 2013 and cases diagnosed from that time frame had allowed adequate time for its implementation thus making assessment of adherence feasible. In order to fulfil the six month follow up time, only patients diagnosed with hypertension prior to October 2014 were included since data collection for the study started in April 2015.

Sample size and sampling method

Sample size was calculated using Epi Info 7 with confidence limit set at 95%. Prevalence of controlled blood pressure was taken at 26.3%, based on the NHMS, 2006.[17] Taking into account the possible 10% missing data, the final calculated sample size for this study was 331. The sampling was done using stratified random sampling since there was unequal distribution of cases between urban and rural health clinics in the district. We started by determining the percentage of cases contributed by each clinic to the total hypertension cases diagnosed from January to end of September 2014. Then, we multiplied the percentage with total sample needed (i.e. 331) in order to get the number of medical records needed to be reviewed from each clinic in the district. At each clinic, all patients who fulfilled the inclusion criteria were listed and assigned a number starting from "1". A computer software was used to generate a list of random numbers and medical records with these numbers were selected to be included in the study.

Tool

For the purpose of this study, a standard proforma was designed to help in data collection.

Operational definition

Definition used in this study is in accordance to Malaysian CPG on Hypertension (4th edition)[12] which include:

1. The systolic BP (SBP) and diastolic BP (DBP) at presentation were categorized into stages as follow:
   a. stage I: SBP 140-159mmHg and/or DBP 90-99mmHg;
   b. stage II: SBP 160-179mmHg and/or DBP 100-109mmHg;
   c. stage III: SBP ≥ 180mmHg and/or DBP ≥ 110mmHg.

2. Risk assessment was divided into three domains which were history taking, physical examination and investigation. The tasks in each domains were derived by referring to Table I and the contents were as follow:
   a. history taken: smoking status, family history of premature cardiovascular death (PCVD), past stroke or transient ischemic attack (TIA), past myocardial infarction (MI), past or current history of angina pectoris, and past or current history of heart failure;
   b. physical examinations: blood pressure, carotid bruit auscultation, fundus examination done or ordered, peripheral pulses palpation, cardiovascular (CVS) and respiratory examination for heart failure;
   c. investigations done or ordered: electrocardiogram (ECG), urine protein, renal profile (RP), fasting lipid profile (FLP) and random or fasting blood sugar (FBS/RBS).

Irrespective of positive or negative findings in the tasks from history taking and physical examinations, as long as these findings were recorded in the patients' medical record, the tasks were considered done. As for list of investigations, tasks were considered done if the results were available or documentation that the tests were ordered. Additionally, tasks which were left out during the initial visit but done within six months were still accepted as completed tasks.

From our consensus, adherence in a domain was achieved if all the tasks under it were fulfilled. A comorbid was considered presence if documentation of it was noted in history taking section of the medical record or inferred from investigations result. Risk level was stratified accordingly in reference to Table I.

3. Pharmacological treatment adherent to guideline was defined as appropriate first line anti-hypertensive prescribed after taken into account individual's comorbidity:

a. angiotensin converting enzyme inhibitors (ACE-i), angiotension II receptor blockers (ARB), beta blockers (BB), calcium channel blockers (CCB) or diuretics prescribed for patients without co-morbid;
b. ACE-i or ARB for patients with diabetes;
c. diuretics for patients 80 years and above without comorbid;
d. ACE-i or ARB for patients with chronic kidney disease (CKD) and/or proteinuria;
e. ACE-i, ARB or BB for patients with cardiovascular disease (CVD) such as MI, and angina pectoris;
f. ACE-i, ARB, BB or diuretics for patients with heart failure;
g. ACE-i or ARB for patients with stroke or TIA.

4. As for BP control, the definition of controlled BP was as follow:

a. SBP <150mmHg and DBP <90mmHg for patients 80 years and above with or without comorbid;
b. SBP <140mmHg and DBP <90mmHg for patients with low and medium risk;
c. SBP <140 mmHg and DBP <80mmHg for patients with high risk;
d. SBP <130mmHg and DBP <80mmHg for patients with very high risk.

This was assessed using the BP measured at the six months follow up visit.

CPG adherence was divided into good and poor adherence determined by four domains physician adhered to (consists of prescription adherent to guideline and three risk assessment domains which were history taking, physical examinations and investigations). There was no such categorisation found from other study on hypertension thus our consensus was adherence to at least two out of four domains (≥50%) was considered as good adherence in reference to a study from South Korea regarding heart failure.[18]

Number of consultation was defined as number of visits by patient for hypertension and non-hypertension related problems after the initial diagnosis. Treatment intensification was defined as dose increment, addition and switching of anti hypertensive medications during the follow up.[19]

Data analysis

Data was analysed using SPSS version 22. Descriptive analysis was used to analyse the variables whereby the categorical data was described as frequency and percentage while numerical data was described as mean and standard deviation (SD). Simple logistic regression was used to identify significant independent variables for blood pressure control which had p value <0.250. These variables were then analysed using multiple logistic regression to determine the independent predictors of controlled blood pressure. Results from multiple logistic regression were presented as beta (β), adjusted odds ratio (aOR), 95% confidence interval (95% CI) and p value. Multicollinearity and interaction were assessed and model fitness tested with Hosmer-Lemeshow test, overall classification percentage and area under receiver operating characteristic (ROC) curve. Lastly, steps from simple logistic regression till area under ROC curve were repeated to analyse independent variables for good CPG adherence.

Ethics

Ethical approval was obtained from Human Research Ethics Committee University of Science Malaysia (USM/JEPeM/14090317) and Medical Research & Ethics Committee (NMRR-13-1163-22243).

RESULTS

A total of 331 medical records which fulfilled the selection criteria were collected. The mean age for the selected patients was 58.3 ± 11.33 years and 185 (55.9%) of them were female. Majority of them were Malays (67.7%), 56 (16.9%) were Chinese, 47 (14.1%) were Indians and four (1.3%) were from other races. Mean SBP and DBP at presentation were 157.5 ± 13.87 mmHg and 92.8 ± 9.03 mmHg respectively with majority from stage I (42.9%) and stage II (42.6%) hypertension. The remaining 14.5% was in stage III. Mean body mass index (BMI) was 27.5 ± 5.10 kg/m^2 with most of the patients (72.8%) were in overweight and obese I category. Seventy patients (21.1%) were smoker or ex-smoker, and 239 patients (72.2%) had at least one comorbidity. The three most common comorbidities were dyslipidaemia (45.6%), diabetes (31.7%) and CKD (28.4%). There were 209 patients (63.1%) in the high and very high risk group as compared to 122 patients (36.9%) in medium and low risk. The median for number of medication prescribed initially at diagnosis was one while the median for number of consultations patient attended after diagnosis was three. Intensification of treatment was more commonly (59.8%) practiced by doctors. Table II shows the demographic and clinical characteristics of the patients selected in detail.

Prevalence of controlled BP as defined in the operational definition in this population was 48.3% (160 patients). Mean BMI for the two BP control groups were nearly the same at 27.7 ± 4.96 kg/m^2 for controlled BP group and 27.2 ± 5.22 kg/m^2 for uncontrolled BP group. As for mean BP, the result showed a higher mean SBP (161.7 ± 14.36 mmHg) and DBP (93.6 ± 9.54 mmHg) at presentation for uncontrolled BP group. This also coincided with more patients in stage II and stage III hypertension (69.0%) for that group as compared to controlled BP group (44.4%). The percentage of patients in controlled and uncontrolled BP groups did not differ much in comparison with all types of comorbidities. Majority of patients with uncontrolled BP had high and very high risk level (70.2%) while patients with controlled BP had lesser patients at that risk levels (55.6%). As for the number of consultation after initial visit, the median for the controlled BP group was higher at four compared to three in the uncontrolled BP group. Of note, 65.5% of patients with uncontrolled BP had their treatment intensified by physicians and there was nearly the same percentage and number of patients for both groups which their physicians had a good CPG adherence. On simple logistic regression, the following variables were found to be associated with controlled BP: SBP at presentation, BP stage, risk level and physician's intensification. In addition to variables mentioned above, variables such as age, sex, diabetes and CPG adherence were

Table I: Stratification of patient's risk in developing major cardiovascular events12

Comorbid(s) / BP levels (mmHg)	No RF No TOD No TOC	TOD or RF (1-2) No TOC	TOC or RF (≥3) or Clinical Atherosclerosis	Previous MI or Stroke or Diabetes
SBP 130-139 and/or DBP 80-89	Low	Medium	High	Very High
SBP 140-159 and/or DBP 90-99	Low	Medium	High	Very High
SBP 160-179 and/or DBP 100-109	Medium	High	Very High	Very High
SBP ≥180 and/or DBP ≥110	High	Very High	Very High	Very High

TOD = Target organ damage (left ventricular hypertrophy, retinopathy, proteinuria); TOC = target organ complication (heart failure, renal failure); RF = additional risk factors (smoking, total cholesterol > 6.5mmol/L, family history PCVD); Clinical atherosclerosis (coronary heart disease, carotid stenosis, peripheral vascular disease, TIA, stroke)

Table II: Controlled and uncontrolled blood pressure (BP) according to variables

Factors	BP controlled, n=160 Mean (SD)	BP uncontrolled, n=171 Mean (SD)	Total, n=331 Mean (SD)
Age (years)	59.3 (10.91)	57.3 (11.67)	58.3 (11.33)
BMI (kg/m^2)	27.7 (4.96)	27.2 (5.22)	27.5 (5.10)
SBP1 (mmHg)	153.0 (11.80)	161.7 (14.36)	157.5 (13.87)
DBP1 (mmHg)	91.8 (8.37)	93.6 (9.54)	92.8 (9.03)
Sex			
Female	89 (55.6%)	96 (56.1%)	185 (55.9%)
Male	71 (44.4%)	75 (43.9%)	146 (44.1%)
Race			
Malay	108 (67.5%)	116 (67.8%)	224 (67.7%)
Chinese	33 (20.6%)	23 (13.5%)	56 (16.9%)
Indian	17 (10.6%)	30 (17.5%)	47 (14.1%)
Others	2 (1.3%)	2 (1.2%)	4 (1.3%)
BMI Category			
Normal	22 (13.8%)	29 (17.0%)	51 (15.4%)
Underweight	2 (1.3%)	6 (3.5%)	8 (2.4%)
Overweight	57 (35.6%)	54 (31.6%)	111 (33.5%)
Obese I	60 (37.5%)	70 (40.9%)	130 (39.3%)
Obese II	9 (5.6%)	6 (3.5%)	15 (4.5%)
Obese III	3 (1.9%)	4 (2.3%)	7 (2.1%)
Adherence to Hx			
No	62 (38.8%)	68 (39.8%)	130 (39.3%)
Yes	98 (61.2%)	103 (60.2%)	201 (60.7%)
Adherence to PE			
No	147 (91.9%)	163 (95.3%)	310 (93.7%)
Yes	13 (8.1%)	8 (4.7%)	21 (6.3%)
Adherence to Ix			
No	100 (62.5%)	116 (67.8%)	216 (65.3%)
Yes	60 (37.5%)	55 (32.2%)	115 (34.7%)
Adherence to Tx			
No	40 (25.0%)	49 (28.7%)	89 (26.9%)
Yes	120 (75.0%)	122 (71.3%)	242 (73.1%)
BP stage			
Stage 1	89 (55.6%)	53 (31.0%)	142 (42.9%)
Stage 2	59 (36.9%)	82 (48.0%)	141 (42.6%)
Stage 3	12 (7.5%)	36 (21.0%)	48 (14.5%)
Smoking			
No	127 (79.4%)	134 (78.4%)	261 (78.9%)
Yes	33 (20.6%)	37 (21.6%)	70 (21.1%)
Stroke / TIA			
No	149 (93.1%)	159 (93.0%)	308 (93.1%)
Yes	11 (6.9%)	12 (7.0%)	23 (6.9%)
Diabetes			
No	109 (68.1%)	117 (68.4%)	226 (68.3%)
Yes	51 (31.9%)	54 (31.6%)	105 (31.7%)

Table II: Controlled and uncontrolled blood pressure (BP) according to variables

Factors	BP controlled, n=160 Mean (SD)	BP uncontrolled, n=171 Mean (SD)	Total, n=331 Mean (SD)
Dyslipidemia			
No	92 (57.5%)	88 (51.5%)	180 (54.4%)
Yes	68 (42.5%)	83 (48.5%)	151 (45.6%)
Retinopathy			
No	159 (99.4%)	163 (95.3%)	322 (97.3%)
Yes	1 (0.6%)	8 (4.7%)	9 (2.7%)
CKD			
No	116 (72.5%)	121 (70.8%)	237 (71.6%)
Yes	44 (27.5%)	50 (29.2%)	94 (28.4%)
CVD			
No	145 (90.6%)	157 (91.8%)	302 (91.2%)
Yes	15 (9.4%)	14 (8.2%)	29 (8.8%)
Comorbid			
No	49 (30.6%)	43 (25.1%)	92 (27.8%)
Yes	111 (69.4%)	128 (74.9%)	239 (72.2%)
Risk level			
Low	34 (21.3%)	14 (8.2%)	48 (14.5%)
Medium	37 (23.1%)	37 (21.6%)	74 (22.4%)
High	25 (15.6%)	38 (22.2%)	63 (19.0%)
Very high	64 (40.0%)	82 (48.0%)	146 (44.1%)
CPG adherence			
Poor	60 (37.5%)	70 (40.9%)	130 (39.3%)
Good	100 (62.5%)	101 (59.1%)	201 (60.7%)
Intensification			
No	74 (46.3%)	59 (34.5%)	133 (40.2%)
Yes	86 (53.7%)	112 (65.5%)	198 (59.8%)

BP, blood pressure; BMI, body mass index; SBP1, systolic BP at presentation; DBP1, diastolic BP at presentation; Hx, history taking; PE, physical examination; Ix, investigations; Tx, treatment.

Table III: Associated factors of blood pressure (BP) control by simple and multiple logistic regression

Variable	Simple Logistic Regression			Multiple Logistic Regression[a]		
	b	Crude OR (95% CI)	p	b	Adjusted OR (95% CI)	p
SBP1	-0.05	0.95 (0.93,0.97)	<0.001	-0.06	0.95 (0.93,0.96)	<0.001
Age	0.02	1.02(0.997,1.04)	0.100	0.03	1.03 (1.004,1.05)	0.016
Sex						
Female	0	1				
Male	0.02	1.02 (0.66,1.58)	0.925			
Diabetes						
No	0	1				
Yes	0.01	1.01 (0.64,1.61)	>0.95			
BP stage						
Stage 1	0	1				
Stage 2	-0.85	0.43 (0.27,0.69)	<0.001			
Stage 3	-1.62	0.20 (0.10,0.42)	<0.001			
Risk level						
Low	0	1				
Medium	-0.89	0.41 (0.19,0.89)	0.024			
High	-1.31	0.27 (0.12,0.60)	<0.001			
Very High	-1.14	0.32 (0.16,0.65)	0.002			
Intensif.						
No	0	1				
Yes	-0.49	0.61 (0.39,0.95)	0.030			
Tx Adh						
No	0	1				
Yes	0.19	1.20 (0.74,1.96)	0.454			
CPG Adh						
Poor	0	1				
Good	0.14	1.16 (0.74,1.80)	0.523			

SBP1, systolic blood pressure at presentation; Intensif., intensification; Tx Adh, guideline adherent prescription; CPG Adh, overall adherence to CPG; OR, odds ratio; CI, confidence interval.

[a]Forward LR Multiple Logistic Regression was applied. Multicollinearity and interaction term were checked and not found. Hosmer-Lemeshow test, (p=0.256), classification table (overall correctly classified percentage=66.2%) and area under the ROC curve (70.6%) were applied to check the model fitness.

Table IV: Associated factors of clinical practice guidelines (CPG) adherence by simple and multiple logistic regression

Variable	Simple Logistic Regression			Multiple Logistic Regression[a]		
	b	Crude OR (95% CI)	p	b	Adjusted OR (95% CI)	p
CKD						
No	0	1		0	1	
Yes	-0.50	0.61 (0.38,0.99)	0.045	-0.67	0.51 (0.31,0.85)	0.007
CVD						
No	0	1		0	1	
Yes	0.98	2.67 (1.06,6.75)	0.038	0.99	2.68 (1.04,6.95)	0.030
Intensification						
No	0	1		0	1	
Yes	0.67	1.96 (1.25,3.07)	0.004	0.69	2.00 (1.26,3.19)	0.009
BMI category						
Normal	0	1				
Underweight	-1.58	0.21 (0.04,0.98)	0.047			
Overweight	-0.61	0.54 (0.26,1.13)	0.102			
Obese I	-0.79	0.45 (0.22,0.93)	0.030			
Obese II	-0.06	0.94 (0.26,3.47)	0.927			
Obese III	-0.79	0.46 (0.09,2.31)	0.343			
Sex						
Female	0	1				
Male	0.28	1.32 (0.84,2.06)	0.226			
Smoking						
No	0	1				
Yes	-0.41	0.66 (0.39,1.13)	0.130			
Dyslipidemia						
No	0	1				
Yes	0.38	1.46 (0.93,2.28)	0.099			
Consultation	0.21	1.23 (0.94,1.60)	0.126			

CKD, chronic kidney disease; CVD, cardiovascular disease; BMI, body mass index; Consultation, number of consultation after diagnosis
[a]Forward LR Multiple Logistic Regression was applied. Multicollinearity and interaction term were checked and not found. Hosmer-Lemeshow test, (p=0.763), classification table (overall correctly classified percentage=63.7%) and area under the ROC curve (62.5%) were applied to check the model fitness.

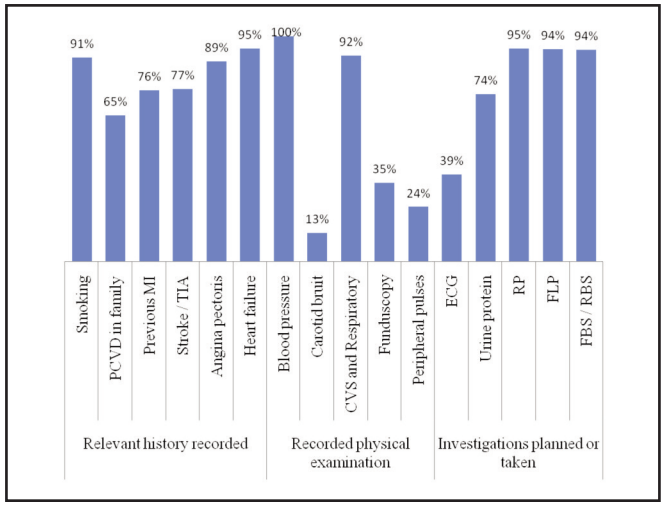

Fig. 1: Clinical and laboratory assessments required to risk stratify hypertensive patient.

added into multiple logistic regression because we opined that these variables have clinical significance despite being not significant in simple logistic regression. The results from multiple logistic regression showed that age and SBP at presentation were the significant independent factors associated with controlled BP (Table III).

Majority of doctors had good overall CPG adherence (60.7%). On descriptive analysis of each domains, it was noted that adherence to history taking and prescription were above average at 60.7% and 73.1% respectively. Adherence to required physical examinations was the least at 6.3% followed by adherence to investigations (34.7%). Sub analysis of the tasks required in each domain was illustrated in Figure 1 and noted that checking carotid bruit, peripheral pulses, fundus examination and ECG were lesser fulfilled task (13%, 35%, 24% and 39%). Simple logistic regression obtained the following significant variables for good CPG adherence: smoking status, sex categories, BMI categories, dyslipidaemia, CKD, CVD, intensification of treatment and number of consultations. On multiple logistic regression, there were three significant independent factors associated with physician's good CPG adherence which were the presence of CVD, CKD and treatment intensification (Table IV).

DISCUSSION

Our study showed that 160 patients (48.3%) had their hypertension controlled. This was at par with local results by Oteh et al. and Cheong et al. which were 48.5% and 48.3% respectively.[5,20] Study by the latter was done in public health clinics and used the latest edition of hypertension CPG hence our results were comparable. Furthermore, both of our health clinics were located in urban and semi-urban areas. On the other hand, study by Rampal et al. which was a population survey throughout Malaysia found that only 26.8% of hypertension patients had controlled BP.[4] Such discrepancy showed that difference in study population and methodology

should be taken into account when interpreting these results. Overall, hypertension control at such level is still considered sub-optimal taking into consideration so many years of improvement in healthcare accessibility and facilities. Therefore, underlying reasons should be explored to strategise a plan and improve this dire situation.

SBP at presentation was found to be negatively associated to BP control (adjusted OR= 0.95, 95% CI: 0.93, 0.96, p< 0.001) which concurred with studies done overseas.[21,22] This finding is clinically important because it may facilitate attending doctors to make an earlier decision to intensify treatment for patients presented with higher baseline BP to prevent poor outcome.

Older age has been a well known negative associated factor to BP control[22-24] The reason for this may be due to increase in arterial stiffness and poor treatment adherence with advancing age.[25] However, result from our study was contradicting whereby older age was found to have positive association with controlled BP (adjusted OR= 1.03, 95% CI: 1.004, 1.05, p= 0.016). This may be due to presence of 11 patients (3.3%) age 80 years and above which their definition of controlled BP was less than 150/90mmHg, a higher range compared to patients less than 80 years old. Besides that, there may be underlying characteristics or advantages in this elderly population which promotes better BP control such as good compliance, better family and social support, healthier lifestyle and more health conscious. Nonetheless, these speculations should be studied and the result can help us to understand this subpopulation better and personalised care can be implemented.

CPG adherence has been emphasised to doctors for a long time as this was said to improve hypertension management outcome.[7] Contrary to that, our study did not find any association between BP control and good overall CPG adherence. It is not feasible to compare this result with other study because such research is non-existence at the moment. At the same time, subgroup analysis was done between guideline adherent prescription and BP control which also yielded insignificant finding despite multiple studies done in the past shown otherwise.[8,9] This suggests that guideline adherent as a whole or only towards prescription practice (physician's factor for BP control) was inadequate. So, we postulated that patient's factor (etc: compliance to medication, accessibility to healthcare and clinical profile) plays an equally important role in managing hypertension for this population.[7] Therefore, both factors should be presence concurrently to achieve a good BP control. In pursuance of this, other than training our doctors to be CPG adherent, educating patients about hypertension and importance of compliance to both pharmacological and non-pharmacological treatment should also be emphasised.

Overall CPG adherence in our study was slightly above average at 60.7% but comparing our result with other studies was not possible due to difference in definition of good CPG adherence. So, we were unable to comment whether this level of adherence was adequate. However, comparing CPG adherent prescription with local studies was feasible by which our study showed a poorer performance compared to Abdulameer et al. but better than Ahmad et al.; 73.1% versus 85.3% and 67.1% respectively.[8,11] Nevertheless, these comparisons should be interpreted cautiously because of difference in study populations which the two studies mentioned used tertiary hospital patients whereas our study used primary care patients. In addition to that, the former also used 3rd edition of the hypertension CPG which have differences such as target BP for patients with different risk level and recommended first line medications.

A study done in New Zealand which evaluated physical examination completeness by junior doctors showed a worsening trend over four decades and examining for carotid bruit and fundus were noted as the least performed physical examinations.[26] This finding concurred with our study and we agreed to the reasons suggested by the authors that busy workloads and lack of skills might be the contributing factors. These reasons may also hold true to the cause of lower rate in checking peripheral pulses in our study. We postulate that perception of these examinations as non-routine and troublesome might be the additional reasons behind this finding but further study is needed to confirm this and to explore other reasons. At the same time, it was also noted that ECG was the least ordered investigation and this corresponded to a study done in Saudi Arabia which showed majority of patient (59.2%) had no ECG performed before.[27] In our setting, it is a routine for primary care clinics to order yearly blood and urine investigations for non-communicable diseases such as diabetes, dyslipidaemia and hypertension. However, ECG is often omitted as it is more time consuming as compared to blood and urine sampling. Overall, cardiovascular risk assessment in our study (history taking, physical examinations and laboratory investigations) was unsatisfactory and this result was similar to few other studies.[15,27,28] Therefore, steps to rectify this inadequacy such as continuous medical education, group discussion and setting targets should be implemented.

In our study, treatment intensification was found to be an independent factor for CPG adherence (adjusted OR= 2.00, 95% CI: 1.26, 3.19, p< 0.009) and this association was logical because without understanding and good practice of our guideline, intensification of treatment might not happen despite uncontrolled BP while taking the same anti-hypertensive since diagnosis. CVD was another significant independent factor for good CPG adherence (adjusted OR= 2.68, 95% CI: 1.04, 6.95, p< 0.030) and this finding was in agreement with a hypothesis by Piette and Kerr that patients with concordant comorbid conditions which had same pathophysiological pathway will be more likely to receive guideline adherent management.[29] For instance, hypertension guideline commonly had recommendations for CVD patients and vice versa for CVD guideline, thus serving as safety net and reminder for physician to have a complete assessment and appropriate management irrespective of which guideline was used. However, we found negative association between CKD and physician's CPG adherence (adjusted OR= 0.51, 95% CI: 0.31, 0.85, p< 0.007) despite being classified as concordant comorbid for hypertension.[30] Similar finding was also found in an American study whereby presence of CKD increased odds of JNC 7 non-adherent medications prescribed.[9] We postulated that doctors' lack of knowledge in management of hypertension in CKD patients and hesitant use of ACE-i/ARB (worry of

worsening renal profile and requiring regular monitoring) are the causes of this finding. Further research using either qualitative or quantitative method may enlighten us regarding this issue.

The strength of our study was the use of stratified random sampling which represented the cases distribution in urban and semi-urban health clinics. Besides that, latest hypertension CPG used as reference was the best to reflect the current evidence based practice. However, there were few methodological and statistical weaknesses in our study. The first methodological weakness was the use of cross sectional study which was not a good research method to show causal relationship. Secondly, patients diagnosed with diabetes first whom later developed hypertension were not included in this study because extracting such data from national diabetes registry is not feasible at the moment and laborious if to be retrieved manually. Other than that, information obtained from medical record was incomprehensive as it only showed what had been done by physician but not what was understood about CPG content. Furthermore, physician might have the tendency of incomplete or incomprehensible documentation due to busy clinic day. The last methodological weakness was our subjective definition of CPG adherence whereby the cut off number of tasks or domains needed to be considered as good CPG adherence was not validated. As for statistical weakness, classification table for both BP control and CPG adherence were below 70% and area under ROC curve for CPG adherence was less than 70%.

CONCLUSION

BP control in our study population was poor. Attention should be given to patients' SBP at presentation and their age to decide on treatment intensification. CPG acts as a decision support tool in chronic disease management and this study shown that there is still room for doctors to improve their adherence to the latest hypertension CPG. Nonetheless, this should go in tandem with other components of chronic care model to achieve favourable outcome in hypertension management.

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