BLOOD PRESSURE CONTROL AMONG DIABETIC HYPERTENSIVES UNDER CARDIOLOGY FOLLOW-UP AT A REGIONAL HOSPITAL IN RURAL MALAYSIA

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Abstract. Three hundred thirty-one consecutive patients presenting with hypertension to the outpatient medical clinic of Tengku Ampuan Afzan Hospital, Kuantan, Malaysia were screened and 150 patients with concurrent diabetes were enrolled into a cross-sectional study. The majority of patients were male (60.6%) with a mean age of 60.0 ± 11.0 years. The mean systolic blood pressure (SBP) was 140.9 ± 20.1 mmHg and the mean diastolic blood pressure (DBP) was 81.7 ± 9.8 mmHg. Only 38.0% (57/150) of patients had blood pressures within recommended guidelines (130/80 mmHg). The mean blood pressure in this group was 123.7 ± 8.5/76.4 ± 5.6 mmHg. The majority of patients were on either 2 (41.3%) or 3 (31.3%) anti-hypertensives. Females had a significantly higher SBP 145.4 ± 22.7 *vs* 138.0 ± 17.8 mmHg in males (p=0.026). The level of blood pressure control in diabetics was unsatisfactory, especially in females and the elderly. A reassessment of priorities in the management of patients with concurrent hypertension and diabetes is therefore, urgently needed.

Key words: blood pressure, hypertension, diabetes, Malaysia

INTRODUCTION

Cardiovascular disease has been the leading cause of death in Malaysia since the early 1980's (Jeyamalar, 1991). This is most likely a reflection of the high prevalence of both hypertension and type 2 diabetes in the population (Lim *et al*, 2004). Uncontrolled hypertension in patients with type 2 diabetes is a major contributor to macrovascular complications which include cardiovascular diseases (Haffner *et al*, 1998; Sowers, 2004). Worldwide, the level of hypertension control has dropped precipitously in populations with concurrent hypertension and type 2 diabetes due to lower blood pressure goals in diabetics (Berlowitz *et al*, 2003; Naik *et al*, 2007).

Data regarding hypertension control in the community is fragmented, but it shows a tiered pattern of progressively better control, beginning with the population study level (6%), then public clinics (26%) and finally private primary care clinics (59%) (Lim *et al*, 2004; Omar *et al*, 2004; Chan *et al*, 2005). Data regarding the level

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of hypertension control amongst patients with concurrent type 2 diabetes and hypertension is almost non-existent, but it is estimated the level of control is poorer than among those with only hypertension without diabetes, similar to elsewhere (Naik *et al*, 2007).

The importance of this information cannot be underestimated. Studies have shown with greater hypertension control, the attendant costs associated with its complications will fall (SHEP, 1991; Kostis *et al*, 1997; Chobanian *et al*, 2003). This is heightened by the fact that 32.5% of the population in rural Malaysia are at high risk of developing cardiovascular diseases (Hapizah *et al*, 2002). The need for risk factor control is more pertinent in developing economies, such as Malaysia, where the majority of patients obtain health care from public institutions with limited budgets.

The objective of this study is to determine blood pressure control amongst patients with concurrent type 2 diabetes and hypertension in rural Malaysia and to identify specific sub-groups at higher risk for poor blood pressure control. It is hoped the results for this study will be used to better apportion the limited resources available to rural communities in Malaysia specifically, and in developing countries worldwide in general.

MATERIALS AND METHODS

The study was conducted at the outpatient cardiology clinic of the Tengku Ampuan Afzan Hospital, Kuantan, Malaysia. Kuantan is the capital of the east coast peninsular Malaysian state of Pahang which serves a population of one and a half million people, has a predominantly agrarian economy and the majority of the population is looked after by the public health care sector. These patients pay a nominal flat fee which covers both the cost of consultation and treatment.

Three hundred thirty-one consecutive patients with hypertension attending the outpatient cardiology clinic were screened, and 150 patients with concurrent diabetes, who satisfied the inclusion criteria, were enrolled in the cross-sectional study between June and August 2007. The study protocol was approved by the medical research and ethics committee of the institution, and written informed consent was obtained from each subject.

All Malaysian citizens ≥30 year old who had been diagnosed with and were under treatment for type 2 diabetes mellitus for at least 6 months were included in the study. The diagnosis of type 2 diabetes was made based on the fasting blood sugar and/or oral glucose tolerance test results, according to WHO criteria (Expert Committee, 2003). Patients who were pregnant, had newly diagnosed type 2 diabetes, defaulted treatment for more than six months, were critically ill, had mental health problems or difficulty in communication were excluded from the study.

Two sitting systolic and diastolic blood pressure readings were taken manually three minutes apart using a standard mercury sphygmomanometer (cuff size 12.5 x 40 cm) by an attending physician. The systolic (SBP) and diastolic pressures (DBP) were read to the nearest 2 mmHg and the appearance (phase 1) and disappearance (phase 5) of Korotkoff's sounds were the criteria for SBP and DBP. Controlled blood pressure was defined as <130/80 mmHg (Chobanian *et al*, 2003).

Simple demographic data and antihypertensive medications were recorded. The anti-hypertensive agents were classified into seven major groups: angiotensin converting enzyme (ACE) inhibitors

Table 1
Demographic and risk factor profile of patients screened at cardiology clinic.

	Total sample $n = 331$	Hypertension $n = 181$, (54.7%)	Hypertension + diabetes $n = 150$, (45.3%)	p-value
Age (years)	60.0 ± 11.0[a]	59.9 ± 11.4[a]	60.3 ± 10.5[a]	0.723[b]
Gender				
Males	214 (64.7%)	123 (67.9%)	91 (60.6%)	
Females	117 (35.3%)	58 (32.1%)	59 (39.4%)	
Systolic BP (mmHg)	139.4 ± 21.0 [a]	138.1 ± 21.6[a]	140.9 ± 20.1[a]	0.218[b]
Diastolic BP (mmHg)	81.6 ± 10.4[a]	81.6 ± 10.9[a]	81.7 ± 9.8[a]	0.901[b]
No of antihypertensives	2.2 ± 0.9[a]	2.1 ± 0.8[a]	2.3 ± 0.9[a]	0.036[b]
Risk factor profile				
Ischemic heart disease	244 (73.7%)	133 (73.5%)	111 (74.0%)	0.496[c]
Revascularization	79 (23.9%)	49 (27.1%)	30 (20.0%)	0.091[c]
Renal impairment	65 (19.6%)	27 (14.9%)	38 (25.3%)	0.012[c]
Smoking	67 (20.2%)	40 (22.1%)	27 (18.0%)	0.225[c]
Hyperlipidemia	245 (74.0%)	135 (74.6%)	110 (73.3%)	0.398[c]

[a]Mean ± (SD); [b]p-value from independent sample t-test; [c]p-value from chi-square

(Captopril, enalapril, perindopril, ramipril) and angiotensin receptor (ARB) blockers (losartan, irbesartan, valsartan, telmisartan), calcium-channel blockers (nifedipine, diltiazem, amlodipine, felodipine), diuretics (chlorothiazide, furosemide, spironolactone), β-blockers (propanolol, metoprolol, atenolol, bisoprolol, carvedilol), the α-blocker prazosin and the centrally acting agent methyldopa. Other drug classes, such as the vasodilator hydralazine, were omitted due to rare use.

Statistical analysis

Data for continuous, closely symmetrical variables were analyzed using standard descriptive methods to estimate means and standard deviations (SD). Comparison between means was done using the independent sample t-test. Discrete data and proportions were compared using the chi-square test with the level of statistical significance set at $p<0.05$. All statistical analyses were performed with the statistical software package for the social sciences, SPSS (version 12, SPSS, Chicago, IL).

RESULTS

Three hundred thirty-one patients with hypertension were screened; of these 64.7% (214/331) were males, 73.7% (244/331) had ischemic heart disease and 23.9% (79/331) had revascularization procedures either via coronary artery bypass graft surgery (CABG) or percutaneous coronary intervention (PCI). Eighty-seven percent (288/331) of patients were on at least 1 antiplatelet medication and 90.9 % (301/331) were on statins. Table 1 summarizes the demographic characteristics and risk factor profile of patients with and without type 2 diabetes.

One hundred fifty patients with concurrent hypertension and type 2 diabetes were enrolled in this cross-sectional study.

Table 2
Comparison of male and female diabetic hypertensives.

	Total sample $n = 150$	Males $n = 91$, (60.7%)	Females $n = 59$, (39.3%)	p - value
Age (years)	60.3 ± 10.5[a]	59.6 ± 9.1[a]	61.2 ± 12.3[a]	0.935[b]
Systolic BP (mmHg)	140.9 ± 20.1[a]	138.0 ± 17.8[a]	145.5 ± 22.7[a]	2.243[b]
Diastolic BP (mmHg)	81.7 ± 9.8[a]	81.8 ± 10.1[a]	81.6 ± 9.4[a]	0.099[b]
No of antihypertensives	2.3 ± 0.9[a]	2.4 ± 0.9[a]	2.2 ± 0.8[a]	1.628[b]
Risk factor profile				
Ischemic heart disease	111 (74.0%)	71 (78.0%)	40 (67.8%)	1.945[c]
Revascularization	30 (20.0%)	24 (26.4%)	6 (10.1%)	5.973[c]
Renal impairment	38 (25.3%)	22 (24.2%)	16 (27.1%)	0.109[c]
Smoking	27 (18.0%)	25 (27.4%)	2 (3.4%)	14.926[c]
Hyperlipidemia	109 (72.7%)	68 (74.7%)	41 (69.5%)	0.313[c]

[a] Mean ± (SD); [b] p-value from independent sample t-test; [c] p-value from chi-square

Table 3
Mean values for age, systolic blood pressure (SBP) and diastolic blood pressure (DBP) in 150 hypertensive diabetics by number of antihypertensives used.

Variable	Number of antihypertensives				
	1	2	3	4	5
Age	59.3	59.2	61.0	62.3	73.5
SBP	134.7	135.6[a]	146.9	154.0	160.0
DBP	79.6	79.7[a]	84.8	84.2	85.0

[a] $p<0.05$ *vs* 3 antihypertensives by independent sample t-test

Sixty point six percent of patients were males who had a significantly lower mean systolic blood pressure of 138.0 ± 17.8 mmHg *vs* 145.5 ± 22.7 mmHg in females (± SD) ($p = 0.026$). Males tended to have more antihypertensives prescribed; a higher percentage had ischemic heart disease and subsequent revascularization procedure and concurrent hyperlipidemia (Table 2).

Evaluation of antihypertensives prescribed in subjects revealed the majority were on at least two (62/150, 41.3%) or three (47/150, 31.3%) antihypertensives. Only 26 (17.3%) were on monotherapy (Fig 1). The greater the number of antihypertensives, the higher the mean SBP and DBP were. The patients also tended to be older (Table 3). Eighty-nine point three percent (134/150) of patients were on statins and 86.6% (130/150) were on at least one antiplatelet medication.

We looked at the different types of antihypertensives utilized in these patients; the most common agents used by order of frequency were angiotensin converting enzyme inhibitors or angiotensin receptor antagonists, β-antagonists and diuretics (Fig 2).

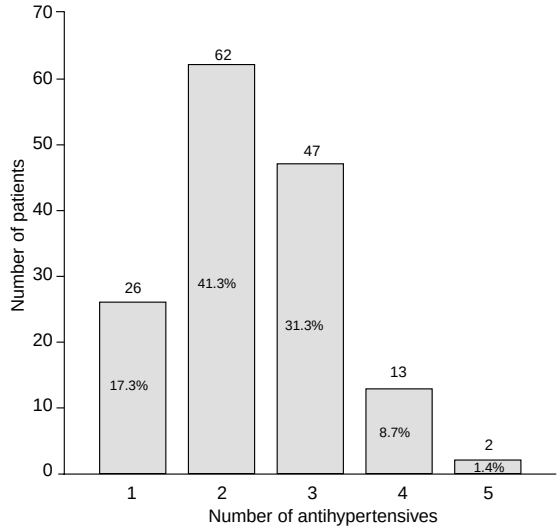

Fig 1–Percent of patients on different numbers of antihypertensives.

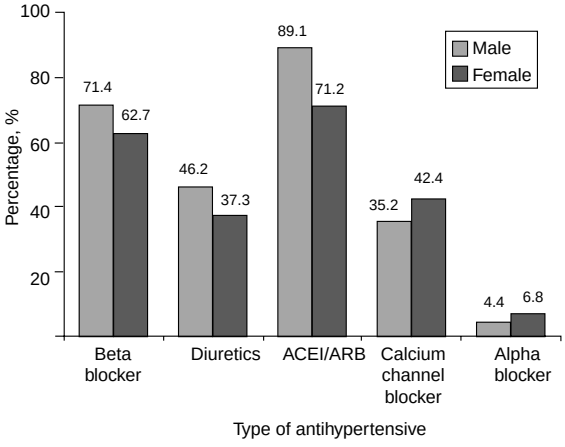

Fig 2–Percentage of antihypertensives utilized in male and female patients.

When we looked at hypertension control among diabetic hypertensives, we found 38.0% of patients had blood pressures under the recommended cut-off level of 130/80 mmHg (Chobanian *et al*, 2003). The mean blood pressure in this group was 123.7 ± 8.5 / 76.4 ± 5.7 mmHg. These patients tended to be younger with a mean age of 57.9 ± 10.3 years and on fewer antihypertensives 2.12 *vs* 2.49 in the poorly controlled group (Table 4).

Twenty-five point three percent (38/150) of patients were identified as having renal impairment, only 13.2% (5/38) of them had a blood pressure <125/75 mmHg (Chobanian *et al*, 2003). The mean systolic and diastolic blood pressures in patients with renal impairment and normal renal function were SBP 147.2 ± 22.7 *vs* 138.5 ± 19.2 mmHg (p=0.025) and DBP 80.6 ± 11.9 *vs* 81.8 ± 9.2 mmHg (p=0.522), respectively. Patients with renal impairment tended to be older than those with normal renal function 65.0 ± 7.7 *vs* 58.7 ± 10.9 years (p=0.001), respectively.

Our data suggest the level of hypertension control in patients with concurrent type 2 diabetes and hypertension was poor. The situation appears to be worse among females, the elderly and those with renal impairment. In patients with renal impairment, the level of control is far worse, where only 13.2% of patients had blood pressures below the recommended 125 / 75 mmHg level.

DISCUSSION

The prevalences of diabetes mellitus and glucose intolerance among adults >30 years old in Malaysia are reported to be 7% and 5%, respectively (Lai *et al*, 2005). Along with a hypertension prevalence of 33%, they contribute to a rising incidence of cardiovascular disease (CVD) (Lim *et al*, 2004). It is estimated 32.5% of adults in rural areas of Malaysia are at high risk of developing cardiovascular disease (Hapizah *et al*, 2002). These contribute to the high prevalence of CVD and mortality in Malaysia.

This was reflected in our study which found 73.7% of patients seen at our clinic had documented CVD, of which only 23.9%

Table 4
Percent of diabetic hypertensive patients with good blood pressure control and the mean values.

	Total sample $n = 150$	Controlled[a] group $n = 57$, (38.0%)	Uncontrolled group $n = 93$, (62.0%)	p-value
Age (years)	60.3 ± 10.5[a]	57.9 ± 10.3[b]	61.7 ± 10.3	0.029[c]
Systolic BP (mmHg)	140.9 ± 20.1[a]	123.7 ± 8.5	151.6 ± 17.8	<0.001
Diastolic BP (mmHg)	81.7 ± 9.8[a]	76.4 ± 5.6	85.0 ± 10.4	<0.001
No of antihypertensives	2.3 ± 0.9[a]	2.1 ± 0.9	2.5 ± 0.8	0.017

[a]Controlled group = BP<130/80, uncontrolled group = BP ≥130/80; [b]Mean ± (SD)
[c]p-value from independent sample t-test

benefited from coronary revascularization procedures. This is due to the high cost associated with coronary revascularization, the low to middle income bracket of most patients attending our clinics and the difficulty in commuting to interstate centers for a revascularization procedure which is absent at our hospital.

Many studies have shown once there is better risk factor control, the costs of cardiovascular disease fall (Lim *et al*, 2004). This is especially important in developing economies, such as Malaysia, where primary prevention strategies are better suited to the limited budget healthcare, which is predominantly publicly funded. The cost of treatment for hypertension and diabetes is predominantly borne by the publicly funded health care system. The cost of coronary revascularization is mainly met by the patients themselves, except for those fortunate enough to be in government service.

Interestingly, the mean blood pressures for patients with and without diabetes were similar: 138.1 ± 21.6 / 81.6 ± 10.9 *vs* 140.9 ± 20.1 / 81.7 ± 9.8 (p = 0.218 and 0.901), respectively. Other regional studies found the mean blood pressure in those with concurrent diabetes and hypertension is usually higher (Asia Pacific Cohort Studies Collaboration, 2007). The level of hypertension control was comparable to studies elsewhere (Nilsson *et al*, 2003; Kerr *et al* 2004; Asia Pacific Cohort Studies Collaboration, 2007). Although our data suggest more effort needs to be made to better control blood pressure in patients with concurrent diabetes and hypertension, our findings are still comparable to other countries.

In our study, blood pressure was controlled in patients with concurrent diabetes and hypertension in only 38.0% (Table 4). In those with renal impairment the level of control was only 13.2 %. There are multiple reasons for poor control, but the most important included poor access to regular medical care, poor compliance due to troublesome side effects, complexity of treatment regimes, especially in those with multiple comorbidities, and lack of time for adequate education and counseling of patients in an under-funded, overstretched public health system (Naik *et al*, 2007). These limitations are amplified in rural societies due to the paucity of treatment centers, limited pharmacopia,

chronic under-staffing and the limited education level of most patients.

The only other study looking at blood pressure control among diabetic hypertensives found only 3.1% of patients achieved the target blood pressure of < 130 / 80 mmHg (Chan, 2005). That study was conducted in a publicly funded primary care clinic and differed substantially from our cohort which is managed in a tertiary referral hospital with a more extensive pharmacopia, attending physicians and a greater surveillance of treatment regimes and follow-up. There are no cohort studies elsewhere in Malaysia to compare our study to.

The antihypertensive prescription use pattern seen in our study mirrors prescription use patterns elsewhere, especially in the United States where there has been a rise in the use of angiotensin converting enzyme inhibitors (ACEI) (Strube, 1993; Yuen *et al*, 1998). This rise in use is due to the finding of the protective effect of ACEI in hypertensive, diabetic and CVD patients, and its subsequent incorporation into the American Diabetes Association (ADA) and the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) guidelines (Chobanian *et al*, 2003). The high prevalence of β-antagonist use is related to the significant number of our patients (74%, Table 1) with documented CVD and the protective effects conferred by β-antagonists in these patients (Chobanian *et al*, 2003). The choice of antihypertensives given to our patients mirrors that of the western world and conforms to most guidelines regarding antihypertensives in patients with concomitant diabetes and hypertension.

When we looked at the level of hypertension control in specific subgroups, we found those with poor control were females, the elderly and those with renal impairment. This is a worrying trend since it reflects complications associated with poor blood pressure control. The greater the age, the higher the risk for CVD with a corresponding rise in systolic and diastolic blood pressure (Franklin *et al*, 2001). Women and the elderly are associated with higher mortality due to acute ST elevated myocardial infarctions (Fibrinolytic Therapy Trialists' Collaborative Group, 1994). Therefore there should be greater blood pressure control in women and the elderly compared to what was observed in our study.

There were several weaknesses associated with this study: there was no documentation regarding the level of diabetes control or the level of renal impairment in these patients. This stems from the relatively simple objective of looking mainly at the level of hypertension control and identification of specific groups at risk for poor control. Our study was conducted in a Medical/Cardiology Outpatient clinic at a tertiary referral hospital in rural Malaysia and our findings may not represent the majority of patients in the catchment area. The common practice here is that most patients with difficult blood pressure control will be referred to our center and once under better control will be sent back to the peripheral, primary care clinics. Although our data does not represent the majority of the population, it does reflect the level of control among patients at the top end of the disease spectrum.

The level of hypertension control in diabetics was unsatisfactory: only 38% of those sampled. Groups with poorer blood pressure control were females, the elderly and those with documented renal impairment in whom the level of control is only

13.2%. This finding mirrors the prevalence of blood pressure control among patients with concomitant diabetes and hypertension from around the world. The pattern of anti-hypertensive drug use reflects the prevailing patterns and specific requirements of this particular cohort of patients. A significant majority (73.7%) of our patients also has concomitant cardiovascular disease, but only 23.8% had a coronary revascularization procedure.

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