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Original Research Article

Hypertension Management and Factors Associated with Blood Pressure Control in Jordanian Patients Attending Cardiology Clinic

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Abstract

Purpose: *To assess modifiable clusters of cardiovascular risk factors and patterns of antihypertensive drugs use as well as identify clinical characteristics associated with blood pressure control in Jordanians.*
Methods*: A cross-sectional observational study was conducted in cardiology outpatient clinics at two hospitals in Amman, Jordan. Outcomes studied were prevalence of cardiovascular risk factors, patterns of antihypertensive medication use, rate of blood pressure control and factors associated with such control.*
Results*: The number of concomitant medical conditions was high: diabetes mellitus (51 %), dyslipidemia (82 %), coronary artery disease (71 %), history of acute coronary syndrome (37 %) or coronary revascularization (64 %). Hypertension was controlled in 44 % of patients. Average number of antihypertensive medications was 2.38 ± 1.21. The most commonly prescribed monotherapy medications were beta-blockers (48 %), followed by angiotensin-converting enzyme inhibitors (ACEIs) with 28 % and angiotensin II receptor blockers (ARBs) with 23 %. Among all patients, beta-blockers (67 %) were also the most prescribed, followed by ACEIs (47 %) and ARBs (41%). Multivariate logistic regression analysis revealed inverse association between BP control and the presence of diabetes mellitus.*
Conclusion*: There is inadequate cardiovascular risk assessment and control of blood pressure in hypertensive patients in Jordan. Several practical measures need to be taken urgently to mitigate these deficiencies.*

Keywords: *Hypertension management, Blood pressure control, Cardiology clinic, Cardiovascular risk factors, Antihypertensive medications.*

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INTRODUCTION

Hypertension is a major factor contributing to the global disease burden [1,2]. The worldwide prevalence of HTN in 2000 was ~26%, affecting around 1 billion people. There is considerable variation among countries with regard to the prevalence (~5 to 70 %) and control rates (~5 to 58 %) for hypertension [3]. Poor control of hypertension can result in ischemic heart disease, heart failure, stroke and chronic renal insufficiency [2].

Major guidelines for hypertension were published in 2003 by World Health Organization /International Society of Hypertension [4], JNC-7

[5] and European Society of Hypertension–European Society of Cardiology [6].

Several studies have found that only 60 % of patients with known hypertension receive treatment, and in fewer than 50 % of treated patients blood pressure was controlled [7]. In the USA, only one third of patients with hypertension undergoing treatment had their blood pressure controlled [5,8]. In Jordan during 2004, about 400,000 (15 %) adults reported hypertension [9]. Very few studies have addressed the management of hypertension in this country. A study of prevalence, awareness and management of hypertension in eastern Jordan revealed that 68.5 % of people who were aware of their diagnosis did not achieve control of their blood pressure [10], and among Bedouins in Northern Jordan, 57.1 % of those aware of their diagnosis did not achieve control [11].

The objectives of this study include assessment of cardiovascular risk factors prevalence, pattern of antihypertensive drugs use, as well as rate of blood pressure control and factors associated with it among Jordanian patients who attend cardiology clinics.

EXPERIMENTAL

Sampling frame

The cross-sectional observational study was conducted by specially trained field workers in outpatient cardiology clinics in Jordan University Hospital and Al-Basheer Hospital in Amman between January 1 2007 and April 1 2007. Physicians who agreed to participate in the study were asked to enroll adult (18 years and above) hypertensive patients of both genders. Information was collected from medical files and during patient interview. Informed consent was obtained from every patient, and the study was approved by the Research Ethical Committees of the Jordan University Hospital and the Jordanian Ministry of Health.

Hypertension was defined as prior diagnosis by a physician, or known blood pressure values >140/90 mm on two or more occasions. Modifiable cardiovascular risk factors studied were obesity, diabetes mellitus, smoking, dyslipidemia and chronic kidney disease.
Obesity was defined as body mass index (BMI) ≥ 30 kg/m^2, and overweight as BMI ≥ 25 kg/m^2, but < 30 kg/m^2. Current smoking was defined as smoking at least one cigarette or waterpipe (also known as a narghile, arghila, hookah , or qalyān) per day up to one month before enrollment. Diabetes mellitus was defined as prior diagnosis by a physician, known fasting plasma glucose values ≥ 126 mg/dL, plasma glucose ≥ 200 mg/dL at any time or current use of hypoglycemic medication. Dyslipidemia was defined as prior diagnosis by a physician or the presence of one or more of the following: low density lipoprotein cholesterol ≥ 140 mg/dL, high density lipoprotein cholesterol < 40 mg/dL, or triglycerides > 150 mg/dL measured after 8 h (or longer) fasting.

Chronic kidney disease was considered to be present if the patient had either a decreased estimated glomerular filtration rate (GFR) (<60 ml/min) or persistent albuminurea > 300 mg/dL. Estimated GFR was calculated using the Modification of Diet in Renal Disease (MDRD) formula (for men, 186 x serum creatinine levels$^{-1.154}$ x age$^{-0.203}$; for women, 186 x serum creatinine levels$^{-1.154}$ x age$^{-0.203}$ x 0.742).

Blood pressure measurement and targets

Blood pressure was measured two times on the right arm supported at heart level with a conventional (mercury) sphygmomanometer and correctly-sized cuff with the participant seated after at least 5-min rest, and with 2 min rest between each measurement. Systolic blood pressure was based on the first Korotkoff phase and diastolic blood pressure on the fifth Korotkoff phase. The average of the two readings was used for analysis.

Hypertension was considered to be controlled if systolic blood pressure was < 140 mm Hg and diastolic blood pressure < 90 mm Hg for general hypertensive population, or systolic blood pressure < 130 mm Hg and diastolic blood pressure < 80 mm Hg in patients with established cardiovascular disease, diabetes mellitus or chronic kidney disease [4-6].

Statistical analysis

All data were entered and analyzed using the SPSS software (version 16.0; SPSS, Inc, Chicago, IL). Chi square (χ^2) was used to test any significance between categorical variables, whereas independent t-test was utilized with non-categorical variables. All *p*-values were two-sided and $p < 0.05$ was considered statistically significant. Univariate analysis was used to determine any association of blood pressure control with the categories of patients' factors that were potentially important based on previous research and clinical judgment (patient's gender, age, body mass index, duration of hypertension, smoking status, number of cardiovascular risk factors, presence of cardiovascular disease, diabetes or renal disease, the number and class of antihypertensive medications).

To assess the independent contribution of patient characteristics to the blood pressure control, we conducted multivariate logistic regression analysis for variables which demonstrated significance (p < 0.05) in univariate analysis. Adjusted odds ratio and 95 % confidence intervals for the probability of blood pressure control were calculated for each predictor to explain the strength of association.

RESULTS

Patients' demographic and medical data

The number of patients enrolled was 408. Their general and clinical characteristics are presented in Table 1. Hypertension was controlled only in 44 % of patients.

Prevalence of modifiable cardiovascular risk factors

Hypertensive patients were checked for modifiable cardiovascular risk factors (smoking, obesity, diabetes mellitus, dyslipidemia and chronic kidney disease). Only 22 patients (5.4 %) had no modifiable risk factors, 107 (26.2 %) had one, 167 (40.9 %) had two, 92 (22.5 %) had three, 20 (4.9 %) had four, and none of the patients had five risk factors.

Assessment and management of cardiovascular risk factors

Table 2 shows proportion of patients who were screened by laboratory or other diagnostic tests for presence of cardiovascular risk factors or hypertension complications. Unfortunately, data on electrocardiogram, abdominal ultrasound, echocardiography and fundoscopic examination were not available in medical files.

Treatment of hypertension

Table 3 shows the proportion of patients receiving different numbers of antihypertensive medications. The mean number of antihypertensive medications was 2.38±1.21 per patient.

Pattern of antihypertensive medications is shown in Table 4. The most commonly prescribed class as monotherapy was beta-blockers, followed by angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and calcium channel blockers. Thiazides accounted to a very small number of cases. Similar pattern was observed in the complete sample of patients receiving antihypertensives.

Table 1: Patients' demographic and medical data (N = 408)

Characteristics	Number (%) or mean±SD (range)
Gender	
Women	215 (52.7)
Age, yrs, mean ± SD (range)	58.60±10.85 (20-89)
Smokers	62 (15.2)
BMI, mean ± SD	31.02±5.30
BMI categories	(N=389)
Normal	39 (10.0)
Overweight, obese or morbid obesity	350 (90.0)
Associated clinical conditions	
Diabetes mellitus	207 (50.7)
Dyslipidemia	336 (82.4)
Cerebrovascular disease	21 (5.1)
Coronary artery disease	190 (46.6)
History of ACS	87 (37.2)
History of CR	173 (63.8)
Peripheral vascular disease	31 (7.6)
Heart failure	70 (17.2)
CKD	59 (14.5)
HTN duration, yrs, mean ± SD	8.00±6.96
SBP, mm Hg, mean ± SD	138.52±19.16
DBP, mm Hg, mean ± SD	83.09±10.90
BP controlled	177 (43.6)
Total cholesterol, mg/dL, mean ± SD	192.01±64.15
LDL cholesterol, mg/dL, mean ± SD	118.32±49.30
HDL cholesterol, mg/dL, mean ± SD	44.36±23.73
Triglycerides, mg/dL, mean ± SD	201.30±118.27
FPG, mg/dL, mean ± SD	138.33±62.13

ACS-acute coronary syndrome (myocardial infarction or unstable angina), BMI – body mass index, BP – blood pressure, COPD – chronic obstructive pulmonary disease, CKD – chronic kidney disease, CR – coronary revascularization, CV – cardiovascular, DM – diabetes mellitus, DBP – diastolic blood pressure, FPG – fasting plasma glucose, HbA1C – glycosylated hemoglobin, HDL – high density lipoprotein, IDDM – insulin-dependent diabetes mellitus, LDL – low density lipoprotein, NIDDM – non insulin-dependent diabetes mellitus, SBP – systolic blood pressure

Table 2: Investigations done for the assessment and management of cardiovascular risk in hypertension patients (N = 408)

Investigation	N (%)
Urine for albumin	87 (21.3)
Serum creatinine or BUN	303 (74.3)
Plasma glucose or HbA1c	295 (72.3)
Total cholesterol	285 (69.9)
Lipid fractions	255 (62.5)
ECG	NA
Abdominal US	NA
Echocardiography	NA
Fundoscopic examination	NA

BUN – blood urea nitrogen, HbA1c – glycated hemoglobin, ECG – electrocardiogram,
US - ultrasound

Table 3: Number of antihypertensive drugs used (N = 408)*

Drug	N (%) or mean±SD
No drug	17 (4.2)
One drug	91 (22.3)
Two drug combination	111 (27.2)
Three drug combination	114 (27.9)
More than 3 drug combinations	75 (18.4)
Number of antiHTN medications used, mean (±SD) (range)	2.38±1.21 (0-6)

Among patient characteristics studied by univariate logistic regression analysis, duration of hypertension, presence of diabetes mellitus, peripheral arterial disease, heart failure and history of acute coronary syndrome were inversely associated, while angiotensin receptor blockers were positively associated with achievement of BP control (Table 5).

Table 4: Distribution of antihypertensive prescriptions according to medications class for patients receiving monotherapy and for the complete sample of patients receiving pharmacotherapy

Drug	N (%)	
	As mono-therapy (N=91)	*Complete sample (N=408)*
ACEIs	25 (27.5)	193 (47.3)
ARBs	21 (23.1)	168 (41.2)
BRBs	44 (48.4)	272 (66.7)
CCBs	13 (14.3)	125 (30.6)
Thiazides	5 (5.5)	124 (30.4)
Loop diuretics	0 (0)	89 (21.8)
Potassium-sparing agents	0 (0)	55 (13.5)
Other antihypertensives	1 (1.1)	16 (3.9)

ACEIs – angiotensin converting enzyme inhibitors, ARBs – angiotensin receptor blockers, BRBs – beta blockers, CCBs – calcium channel blockers

In the final multivariate logistic regression model, only the presence of diabetes mellitus was inversely associated with hypertension control (Odds Ratio 0.50; 95% Confidence Interval 0.32-0.77; p < 0.01).

DISCUSSION

The benefit of blood pressure reduction with antihypertensive drug treatment has become increasingly evident, with decreases in both all-cause mortality and coronary artery disease as shown by multiple clinical trials and epidemiological studies [12]. In 2004 in the US, blood pressure control rates were 61.4 % in men and 35.1 % in women [13]. In our study, despite the average number of antihypertensive medications being 2.38, the blood pressure control rate was only about 44 %, suggesting that hypertensive patients are not treated aggressively enough.

Comparing our results to other studies conducted in Jordan, blood pressure control rate among hypertensive patients who attend cardiology clinics in Amman, the capital of Jordan (44%), is higher than in eastern Jordan (31 %) [10], and close to Bedouins in Northern Jordan (43 %) [11].

Clustering of three or more metabolic syndrome components increases the incidence of cardiovascular disease, and the identification and management of additional risk factors should be encouraged to prevent cardiovascular events in hypertensive patients [14]. Among hypertensive patients in our study, 96.6 % had one or more and 27.4 % had three or more additional risk factors. Our data are in agreement with the finding from the Framingham Heart Study that almost 80 % of patients with hypertension had at least one additional cardiovascular risk factor, while 30 % of men and 32 % of women with hypertension had three or more additional risk factors [15]. Our data also support results from other studies that more than 50 % of hypertensive patients had diabetes, dyslipidemia, or obesity [14,16].

Past studies emphasized that assessment of global cardiovascular risk and titration of multiple antihypertensive drugs are considered to be important for achievement of blood pressure goals in the majority of patients [1]. In our study, investigations for assessment and management of cardiovascular risk factors/diseases were not always available – despite high prevalence of cardiovascular and associated diseases such as diabetes mellitus, dyslipidemia, coronary artery disease, heart failure and chronic renal disease.

The prescription patterns of antihypertensives vary from one country to another [17]. In a study conducted in USA in 2004, diuretics were prescribed at a rate of 33%, calcium channel blockers 26%, angiotensin-converting enzyme inhibitors 34%, angiotensin receptor blockers 25%, and beta-blockers 19 % of hypertension visits [18]. In a cross-sectional, population-based survey in Ontario, Canada, of all hypertensives, 51 and 49 % were on monotherapy compared to 2+ drug therapy with similar control rates (86 % vs. 80 % respectively). In those on monotherapy, a renin-angiotensin system blocker was the most commonly used drug class (62 %), and use of other drug classes was only approximately 10 %. In those on 2+ drug therapy, a renin-angiotensin system blocker was also the most common class (80 %), followed by a diuretic (67 %) [19]. In this

Table 5: Factors associated with BP control in univariate logistic regression analysis: demographic factors and factors related to hypertension

Characteristic, number (%) or mean±SD	%BP controlled	%BP not controlled	Odds Ratio [95% CI]	*p*-value
Age	58.1±11.0	59.0±10.8	-3.07 - 1.25	>0.05
Gender				
Female	41.3	58.7	Reference	
Male	46.1	53.9	1.22 [0.82-1.80]	>0.05
BMI	30.6±5.2	31.3±5.3	-1.79 – 0.34	>0.05
HTN duration	7.1±5.8	8.7±7.7	**-3.02 - -0.52**	**0.04**
# of anti HTN medications	2.27±1.11	2.46±1.29	-0.43 – 0.47	>0.05
Drug classes				
Thiazides				
Yes	43.1	56.9	Reference	
No	43.8	56.2	1.03 [0.67-1.59]	>0.05
Loop diuretics				
Yes	38.6	61.4	Reference	
No	45.0	55.0	1.30 [0.80-2.08]	>0.05
ACEI				
Yes	40.6	59.4	Reference	
No	46.3	53.7	1.25 [0.85-1.85]	>0.05
ARBs				
Yes	49.4	50.6	***Reference***	
No	39.6	60.4	**0.67 [0.45-1.00]**	**0.05**
CCB				
Yes	39.3	60.8	Reference	
No	45.6	54.4	1.30 [0.85-2.00]	>0.05
BRBs				
Yes	43.7	56.3	Reference	
No	43.4	56.6	0.99 [0.65-1.49]	>0.05
Smoking				
Yes	37.1	62.9	Reference	
No	45.1	54.9	1.39 [0.79-2.44]	>0.05
DM				
Yes	36.9	63.1	**Reference**	**0.01**
No	50.5	49.5	**1.75 [1.18-2.56]**	
Cerebrovascular disease				
Yes	33.3	66.7	Reference	
No	44.2	55.8	1.59 [0.63-4.00]	>0.05
Peripheral vascular disease				
Yes	25.8	74.2	**Reference**	
No	45.1	54.9	**2.38 [1.03-5.26]**	**0.04**
Dyslipidemia				
Yes	42.2	57.8	Reference	
No	50.0	50.0	1.37 [0.82-2.27]	>0.05
HF				
Yes	30.0	70.0	**Reference**	
No	46.4	53.6	**2 [1.16-3.57]**	**0.01**
History of ACS				
Yes	33.7	66.3	Reference	
No	46.2	53.8	1.17 [1.03-2.78]	**0.04**
History of CR				
Yes	40.5	59.5	Reference	
No	45.9	54.1	1.25 [0.84-1.85]	>0.05
CAD				
Yes	39.5	60.5	Reference	
No	47.2	52.8	1.37 [0.93-2.04]	>0.05
CKD				
Yes	46.6	53.4	Reference	
No	43.1	56.9	0.87 [0.50-1.52]	>0.05
# CV risk factors	1.85±0.98	2.03±0.92	-0.36 – 0.01	>0.05

ACEI –angiotensin-converting enzyme inhibitors, ARB –angiotensin receptor blocker, BMI –body mass index, BRB – beta-receptor blocker, ACS – acute coronary syndrome, CAD – coronary artery disease, CKD –chronic kidney disease, CR – coronary revascularization, CV -cardiovascular, DM – diabetes mellitus, HF – heart failure, HTN –hypertension and CI – confidence interval study, only 22% received monotherapy, while about 73 % were on two ore more antihypertensive drugs. The most commonly prescribed class of antihypertensives in our study was beta-blockers, both as monotherapy (48 %) and in compete sample of patients who receive antihypertensive drugs (67 %). The second most commonly prescribed class of agents in the complete sample was angiotensin-converting enzyme inhibitors (47 %), followed by angiotensin receptor blockers (41 %), calcium channel blockers (31 %), thiazides (30 %), loop agents (22 %) and potassium-sparing diuretics (14 %).

Our results are consistent with other studies where, despite increased awareness and treatment of hypertension, individuals with a higher risk of coronary artery disease had higher rates of uncontrolled blood pressure compared with the average-risk population [20]. Many other factors are likely to contribute to suboptimal rates of hypertension control: insufficient or inappropriate treatment, lack or unaffordability of drugs, insufficient patient knowledge about disease and/or medications, barriers to implement healthy life style, insufficient follow-up, and poor adherence. Among clinical and medication characteristics studied in multivariate logistic regression analysis, only presence of diabetes mellitus was inversely associated with BP control. In contrast to our results, control rates in Canadian study did not differ in the overall hypertensive population and those with comorbidity [19].

Limitations of the study

The patient sample, while representative of the population receiving primary care mainly in urban clinic may not be representative of all adults with hypertension in Jordan; consequently, the hypertension control rates and patterns of medication use may be overestimated. Hypertension could be recognized and treated by other specialists, but our data focused on cardiologists. We did not study the effects of patient education level, lifestyle and medication adherence, income and insurance status on the blood pressure control. Physician's characteristics that may also impact hypertension control were not investigated. In addition, because of the cross-sectional design, there was no assessment whether the present therapy was the initial one or whether it replaced or amended the original one. Another limitation of this study was the possible selection of the individuals at higher cardiovascular risk among people coming to their cardiologists for the treatment of their high blood pressure compared to the general hypertensive population. Still, this group of patients would receive immediate benefit if a more "aggressive" treatment approach was used. Further large interventional studies are needed in hypertensive population in Jordan, addressing all the above issues.

CONCLUSION

The prevalence of cardiovascular risk factors, such as smoking, obesity, diabetes, dyslipidemia, CKD was high in hypertensive patients. Alarmingly, there is inadequate cardiovascular risk assessment and control of blood pressure in hypertensive patients in Jordan. Several practical measures need to be taken urgently: developing national strategic plan to improve hypertension and cardiovascular risk factors control, encouraging patients to maintain healthy lifestyle, pharmacy-directed interventions (e.g., availability and prescription of generic drugs) and initiatives directed toward physicians (e.g., clinical algorithms and simple flowcharts).

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CONFLICT OF INTEREST

We declare there are no conflicts of interest.

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