

Control and Management of Hypertension at a University Health Centre in Oman

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السيطرة على مرض ارتفاع ضغط الدم وعلاجه بمركز صحي جامعي في عمان

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المخلص: الهدف: تقييم معدل انتشار مرض ارتفاع ضغط الدم والسيطرة عليه وطرق علاجه في مركز صحي بجامعة السلطان قابوس في عمان. **الطريقة:** شملت هذه الدراسة المقطعية الاستيعابية جميع المرضى المصابين بمرض ارتفاع ضغط الدم البالغة أعمارهم 18 سنة أو أكثر. والذين قاموا بمراجعة المركز الصحي بجامعة السلطان قابوس خلال الفترة ما بين عامي 1998 و 2002. تم تحليل قيم ضغط الدم الانقباضي والانقباضي المسجلة في الزيارات الثلاثة الأخيرة للمركز. تم استخدام معايير اللجنة الوطنية المشتركة لمنع وكشف وتقييم وعلاج ارتفاع ضغط الدم (التقرير السابع) لتعريف درجة التحكم بالضغط، أقل من 140 ملليمتر زئبقي للضغط الانقباضي و90 ملليمتر زئبقي للضغط الانقباضي. تم تحليل البيانات باستخدام التحليل الإحصائي ذو المتغير الأحادي. **النتائج:** بعد مراجعة 7702 سجلا طبيا. وجد أن معدل انتشار مرض ارتفاع ضغط الدم هو (2.4% - 187 مريضا). كان متوسط العمر للعينة 55±11 سنة. نسبة النساء بلغت (54% - 101 مريضة). أغلب المرضى كانوا من العمانيين (66% - 123 مريضا). نسبة المرضى المصابين بضغط الدم تحت السيطرة كانت (41% - 77 مريضا). لوحظ أن درجة السيطرة على ضغط الدم كانت أقل لدى العمانيين مقارنة مع غير العمانيين بصورة معتدة إحصائيا (35% مقارنة مع 53% , P= 0.017). معظم المرضى كانوا يعالجون بدواء واحد (70% - 131 مريضا). بينما كان هناك (27% - 50 مريضا) يعالجون بدواءين. كانت أدوية محصرات البيتا ومثبطات تحويل أنزيم الأنجيوتنسين الأكثر شيوعا كأدوية أحادية (34% - 64 مريضا و 25% - 47 مريضا) على التوالي. فيما يخص أدوية العلاج المزدوج كانت أدوية مثبطات تحويل أنزيم الأنجيوتنسين مع محصرات البيتا (28% - 14 مريضا) ومحصرات البيتا مع الأدوية المدرة للبول (24% - 12 مريضا) هي الأكثر شيوعا. **الخلاصة:** إن معدل انتشار مرض ارتفاع ضغط الدم في هذه العينة بعد منخفا بالمقارنة مع المتوسط الوطني. أظهرت هذه الدراسة أن درجة السيطرة على ارتفاع ضغط الدم هو ليس الأمثل ولكنه أعلى من النسب المسجلة في دول أخرى.

مفتاح الكلمات: ارتفاع ضغط الدم . الوقاية والسيطرة . علاج المرض . عمان.

ABSTRACT Objectives: To evaluate the prevalence of hypertension, its control and management at Sultan Qaboos University (SQU) Health Centre, Oman. **Methods:** This was a retrospective cross-sectional study, in which were enrolled all the subjects (≥ 18 years), with the diagnosis of essential hypertension, who attended the SQU Health Centre between 1998 and 2002. The systolic and diastolic blood pressure (BP) values of the last three visits were used for analysis. BP control was defined using the Joint National Committee (JNC-7) criteria, <140 mmHg and <90 mmHg for systolic and diastolic BPs, respectively. Analyses were performed using univariate statistics. **Results:** Among the 7,702 medical records reviewed, the prevalence of hypertension was 2.4% ($n = 187$). The overall mean age of the cohort was 55 ± 11 years, 54% ($n = 101$) were females, and majority of the subjects were Omanis ($n = 123$; 66%). The proportion of subjects who had their BP controlled was 41% ($n = 77$) with Omanis significantly less likely to have their BP controlled compared to non-Omanis (53% versus 35%; $p = 0.017$). The majority of the subjects were on mono ($n = 131$; 70%) followed by dual ($n = 50$; 27%) anti-hypertensive therapies. The most frequent mono anti-hypertensive therapies were B-blockers ($n = 64$; 34%) and angiotensin-converting enzyme (ACE) inhibitors ($n = 47$; 25%). Among the dual combination therapies, the most common prescribed regimens were ACE inhibitor plus B-blocker ($n = 14$; 28%) and B-blocker plus diuretic ($n = 12$; 24%). **Conclusion:** The prevalence of hypertension in this patient population was low compared to the national average. This study shows that control of hypertension is not optimal, but higher than those reported elsewhere.

Key words: Hypertension; Prevention and control; Disease management; Oman.

Advances in Knowledge

- Blood pressure (BP) control in this cohort was low.
- Diabetics, in particular, had a much lower BP control.
- Omanis were significantly less likely to achieve BP targets compared to non-Omanis.
- The majority of the subjects were on mono anti-hypertensive therapy.
- Beta-blockers were the most commonly used monotherapy followed by angiotensin-converting enzyme (ACE) inhibitors.
- The most commonly prescribed dual anti-hypertensive regimens were ACE inhibitor plus beta-blocker and beta-blocker plus diuretic.

Application to Patient Care

- Physicians should be more aggressive in controlling hypertension.
- Physicians should continually update their knowledge with the latest treatment guidelines.
- Combination therapies should be prescribed more often, particularly in diabetics.
- Close attention should be paid to Omanis in order to improve their BP control.

HYPERTENSION IS A COMMON DISEASE WITH significant morbidity and mortality. It is the leading diagnosis made in physician offices in the United States.¹ Twenty-six percent of the world adult population has hypertension.² Moreover, the proportion is expected to rise further in 2025 to 29.2% with an estimated total number of 1.56 billion affected adults.² The reported prevalence varies around the world with the lowest prevalence in rural India (3.4% in men and 6.8% in women) and the highest prevalence in Poland (68.9% in men and 72.5% in women).³ In Oman, a community based survey conducted in 2000 estimated the prevalence of hypertension to be 33%.⁴

High blood pressure (BP) leads to an increasing risk of stroke, myocardial infarction and cardiovascular disease, all of which cause mortality.^{5, 6, 7} Furthermore, hypertension contributes to the prevalence of other cardiovascular risk factors, such as insulin resistance, lipid abnormalities, changes in renal function, obesity, left ventricular hypertrophy, diastolic dysfunction, and abnormalities in vascular structure.⁸ Clinical trials have unequivocally shown that lowering BP reduces cardiovascular morbidity and mortality in patients with hypertension of all degrees of severity.⁸ Despite the significance of the problem with respect to overall health, control of high blood pressure (BP < 140/90 mmHg while on antihypertensive medication) is far from being optimal. Data from the USA (the Na-

tional Health and Nutrition Survey) have shown that those achieving target BP account only for 36% of the hypertensive population.⁹ A control rate of 25% was reported from a primary health care in Saudi Arabia.¹⁰ Researchers from Bahrain have reported a control rate of 16.5%.¹¹ Similar data on hypertension control from Oman is lacking.

The aim of this study was to determine the prevalence of hypertension, its control and management at Sultan Qaboos University (SQU) Health Centre in Muscat, Oman. The SQU Health Centre provides free health care services to all university employees and their dependants.

METHODS

This study included all patients, 18 years and above, who were documented to have "essential hypertension" in their medical records at the Health Centre. The cohort had to have a minimum period of one year follow up. The charts reviewed were of those patients attending the Health Centre over a five-year period between January 1st 1998 and December 31st 2002.

The following information was collected: age, gender, nationality (Omani, non-Omani), the three most recent BP readings, medications, current smoking status (yes, no), body mass index (BMI), the frequency of attendance at the outpatient clinic (within 3 months, 3-6 months, > 6 months), associated chronic diseases and the presence of any complications secondary to

Table 1: Demographic, clinical, healthcare resource use, and pharmaceutical characteristics of the study cohort stratified by blood pressure (BP) goal attainment as per the Joint National Committee (JNC-7) recommendations

Characteristic	Blood Pressure Goal Attainment as per JNC-7		
	No (n = 110)	Yes (n = 77)	p-value
Demographic			
Age, mean±SD, in years	54±11	55±11	0.546
Female gender, n (%)	57 (52%)	44 (57%)	0.472
Omani national, n (%)	80 (73%)	43 (56%)	0.017
BMI, mean±SD, in kg/m ²	30±5.7	31±6.4	0.558
Smoking status, n (%)	8 (7.3%)	4 (5.2%)	0.764
Clinical			
Dyslipidaemia, n (%)	44 (40%)	34 (44%)	0.571
Diabetes mellitus, n (%)	34 (31%)	25 (32%)	0.821
Cardiac disease, n (%)	13 (12%)	5 (6.5%)	0.315
Diabetic nephropathy, n (%)	4 (3.6%)	1 (1.3%)	0.650
Diabetic retinopathy, n (%)	3 (2.7%)	0 (0%)	0.269
Stroke, n (%)	3 (2.7%)	0 (0%)	0.269
Healthcare Resource Use			
Attendance of OPD Visits, n (%)			
Within 3 months, n (%)	91 (83%)	63 (82%)	0.955
Between 3-6 month, n (%)	13 (12%)	10 (13%)	
After 6 months, n (%)	6 (5.5%)	4 (5.2%)	
Pharmaceutical			
Not on anti-hypertensive, n (%)	4 (3.6%)	2 (2.6 %)	0.894
<i>Monotherapy</i>			
Beta-Blocker, n (%)	35 (32%)	29 (38%)	
ACEI, n (%)	23 (21%)	24 (31%)	
ARB, n (%)	7 (6.4%)	1 (1.3%)	
CCB, n (%)	4 (3.6%)	1 (1.3%)	
Diuretic, n (%)	5 (4.6%)	2 (2.6%)	
<i>Dual therapy</i>			
ACEI + Beta-Blocker, n (%)	9 (8.2%)	5 (6.5%)	
ACEI + CCB	3 (2.7%)	1 (1.3%)	
ACEI + Diuretic	2 (1.8%)	1 (1.3%)	
ACEI + ARB	1 (1.0 %)	0 (0%)	
Beta-Blocker + Diuretic, n (%)	7 (6.4%)	5 (6.5%)	
Beta-Blocker + CCB, n (%)	3 (2.7%)	2 (2.6%)	
Beta-Blocker + ARB, n (%)	2 (1.8%)	2 (2.6%)	
Diuretic + ARB	2 (1.8%)	1 (1.3%)	
CCB + ARB, n (%)	2 (1.8%)	0 (0%)	
CCB + Diuretic, n (%)	1 (1.0%)	1 (1.3%)	

SD = Standard deviation; BMI = Body Mass Index; OPD = Outpatient Department; ACEI = Angiotensin Converting Enzyme Inhibitor; ARB = Angiotensin Receptor Blocker; CCB = Calcium Channel Blocker; BP control was defined as casual BP of <140 (systolic) and <90 mmHg (diastolic) as per the JNC-7; Percents are column percents; Differences between groups were analyzed using unpaired Student's t-test, Pearson's χ^2 test, and Fisher's Exact test whenever appropriate.

hypertension.

Descriptive statistics were used to describe the data. For categorical variables, frequencies and percentages were reported. Differences between groups were analyzed using Pearson's χ^2 tests or Fisher's exact tests (for cells less than 5). For continuous variables, means and standard deviations (\pm SD) were presented.

Mean differences between groups were analysed using unpaired Student's t-tests. An a priori two-tailed level of significance was set at the 0.05 level. Statistical analyses were performed using STATA version 9.2 software (StataCorp 2006, Stata Statistical Software; Release 9.2, College Station, TX, USA).

RESULTS

Among the 7,702 charts reviewed, the prevalence of hypertension was 2.4% ($n = 187$). The characteristics of the study cohort are shown in Table 1. The overall mean age of the cohort was 55 ± 11 years, 54% ($n = 101$) were females, and majority of the subjects were Omanis ($n = 123$; 66%). The proportion of subjects who had their BP controlled was 41% ($n = 77$) with Omanis significantly less likely to have their BP controlled compared to non-Omanis (35% versus 53%; $p = 0.017$). Omanis were also slightly more obese compared to the non-Omanis (BMI was 31 versus 29 kg/m^2 ; $p = 0.091$). The proportion of diabetic subjects who had their BP controlled (<130 mmHg systolic and <80 mmHg diastolic) was only 10% ($n = 6$ out of 59 diabetics) [Table 1].

Males were more likely to be smokers than females (12% versus 2%; $p = 0.013$). Furthermore, females were also more obese than their male counterparts (BMI was 31 versus 29 kg/m^2 ; $p = 0.048$). However, there was no statistical difference in hypertension goal attainment between the genders (39% male versus 44% female; $p = 0.472$). The majority of the subjects were on monotherapy ($n = 131$; 70%) followed by dual regimens ($n = 50$; 27%). The most frequent mono anti-hypertensive therapies were B-blockers ($n = 64$; 34%) and angiotensin-converting enzyme (ACE) inhibitors ($n = 47$; 25%). Among the dual combination therapies, the most common prescribed regimens were ACE inhibitor plus B-blocker ($n = 14$; 28%) and B-blocker plus diuretic ($n = 12$; 24%). Those on dual therapies were less likely to attain their goal than those on monotherapies (36% versus 44%; $p = 0.359$; power 12%). However, the dual regimen group also consisted of more diabetics (38% versus 27%; $p = 0.169$; power 25%) as well as those with dyslipidaemia (54% versus 37%; $p = 0.043$).

DISCUSSION

The three main findings in our study were the following: the majority of our subjects (59%) were not treated so as to achieve their target BP, particularly diabetics; Omanis were less likely to have their BP controlled compared to non-Omanis, and the majority of our patients were on monotherapy.

Research conducted worldwide points clearly to the difficulty in achieving satisfactory BP control in a large proportion of treated patients. Worldwide, control rates vary from as low as 5.4% in Korea to as high as 58% in Barbados.³ Numerous factors may

contribute to ineffective hypertension control.¹² Non-adherence with medication is very common amongst hypertensive patients. It has been reported that up to 60% of patients discontinue their anti-hypertensive medications within the first 12 months.¹³ Reasons include complex medication regimens, adverse effects, convenience factors such as dosing frequency, personal health beliefs, and attitudes regarding treatment of an often asymptomatic condition.¹⁴ Physician behaviour could also be a major obstacle to the successful achievement of target BP goals. The major concern relates to the reluctance of physicians to change treatment when BP control is inadequate.¹⁵ The physician might not also be aware of the recent treatment guidelines. For example, a study from the USA reveals that 41% of physicians have not heard of or are not familiar with the reports of the Joint National Committee (JNC), *Detection, Evaluation, and Treatment of High Blood Pressure* and their hypertension treatment guidelines.¹⁶

Patients who have both diabetes and hypertension are at a higher risk of cardiovascular events compared to non-diabetics.¹⁷ The United Kingdom Prospective Diabetes Study (UKPDS) suggests that tight control of BP prevents the development of microvascular and macrovascular complications in patients with Type 2 diabetes.¹⁸ The guidelines of the seventh report of the JNC recommend a target BP of 130/80 in patients who have concomitant diabetes.¹⁹ Physicians, however, appear to be doing a poor job of helping patients with diabetes achieve this goal. In a study by Abbott and colleagues, only 11% of the diabetic patients treated for hypertension were reported to have achieved the systolic BP goal of <130 mmHg.²⁰ In our study, the BP control in diabetics was similar (10%); furthermore, only 27% (16 out of 59) of the diabetics were on dual anti-hypertensive therapies in our study. This is against the JNC¹⁹ recommendations, which clearly state that diabetics be treated with at least two anti-hypertensive medications to obtain optimal BP control.

Possible reasons for the poor control of BP among Omanis are ethnicity, higher prevalence of male gender (55% versus 45%; $p = 0.003$) and obesity (31 versus 29 kg/m^2 ; $p = 0.091$). Racial differences have been documented as a cause for differences in the prevalence, course, and control of hypertension.²¹ For instance, African-Americans were reported to have an increased prevalence of hypertension, higher mean BP levels, and higher morbidity and mortality rates attributable

to hypertension, compared to white Americans.²¹ Hypertensive blacks have a higher incidence of left ventricular dysfunction, stroke, and renal damage, but a lower incidence of ischaemic heart disease, than do hypertensive whites.²² Hypertensive blacks also have lower rates of BP control.²¹ Furthermore, the two races respond differently to anti-hypertensive medications. Blacks respond well to thiazide diuretics, but poorly to B-blockers and angiotensin-converting enzyme (ACE) inhibitors compared to whites.²³ Pathophysiological differences between the two populations such as salt sensitivity, rennin levels and dopamine response to a salt load might be responsible for the differences in effectiveness.²²

Recent clinical trials have shown that effective BP control can be achieved in most hypertensive patients, but to do so requires two or more antihypertensive drugs for most patients.^{24, 25, 26} Thirty to 60% of patients will be controlled with a single drug regimen, while two drugs in combination are likely to improve control rates in 80 to 85%; three or more drugs will provide control in 90 to 95% of patients.²⁷ Most of our patients were on monotherapy. In fact, this might have contributed to unsatisfactory BP control in our subjects. In addition, diuretics which are widely recommended as a first line therapy were only rarely used in our cohort (3.7%) [Table 1]. This low use could be due to the fact that the pharmaceutical industry promotes the use of newer and more expensive alternatives.

This study has two major limitations. The study population is highly educated, and the treatment of hypertension may not be representative of those experienced by the general population. The ideal setting at the university which ensures the availability of a wide variety of anti-hypertensive medications and easy access to the facilities of a tertiary care hospital differ widely from the setting and population in the general community.

CONCLUSION

In conclusion, hypertension is not adequately controlled in our cohort particularly in diabetics. The racial background was a significant factor correlating with BP control. Anti-hypertensive medications were mainly used as monotherapy in contrast to the recent hypertension guidelines as recommended by JNC-7. Further research in a community setting is needed in order to draw more accurate conclusions about the state of hypertension control in Oman.

REFERENCES

- Hing E, Cherry DK, Woodwell DA. National Ambulatory Medical Care Survey: 2004 summary. *Adv Data* 2006; 374:1-33.
- Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005; 365:217-223.
- Kearney PM, Whelton M, Reynolds K, Whelton PK, He J. Worldwide prevalence of hypertension: a systematic review. *J Hypertens* 2004; 22:11-19.
- Al Riyami AA, Afifi MM. Hypertension in Oman: distribution and correlates. *J Egypt Public Health Assoc* 2002; 77:383-407.
- Staessen JA, Gasowski J, Wang JG, Thijs L, Den Hond E, Boissel JP, et al. Risks of untreated and treated isolated systolic hypertension in the elderly: meta-analysis of outcome trials. *Lancet* 2000; 355:865-872.
- Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002; 360:1903-1913.
- Psaty BM, Furberg CD, Kuller LH, Cushman M, Savage PJ, Levine D, et al. Association between blood pressure level and the risk of myocardial infarction, stroke, and total mortality: the cardiovascular health study. *Arch Intern Med* 2001; 161:1183-1192.
- Messerli FH, Williams B, Ritz E. Essential hypertension. *Lancet* 2007; 370:591-603.
- Ong KL, Cheung BM, Man YB, Lau CP, Lam KS. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999-2004. *Hypertension* 2007; 49:69-75.
- Al-Rukban MO, Al-Sughair AM, Al-Bader BO, Al-Tolaihi BA. Management of hypertensive patients in primary health care setting, auditing the practice. *Saudi Med J* 2007; 28:85-90.
- Al Khaja KA, Sequeira RP, Damanhori AH. Treatment of hypertension in Bahrain. *Ann Pharmacother* 2003; 37:1511-1517.
- Vidt DG. New strategies for blood pressure control. *J Hum Hypertens* 2002; 16:S124-127.
- Esposti LD, Di Martino M, Saragoni S, Sgreccia A, Capone A, Buda S, et al. Pharmacoeconomics of anti-hypertensive drug treatment: an analysis of how long patients remain on various antihypertensive therapies. *J Clin Hypertens (Greenwich)* 2004; 6:76-84.
- Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med* 2005; 353:487-497.
- Hyman DJ, Pavlik VN, Vallbona C. Physician Role in Lack of Awareness and Control of Hypertension. *J Clin Hypertens (Greenwich)* 2000; 2:324-330.

16. Hyman DJ, Pavlik VN. Self-reported hypertension treatment practices among primary care physicians: blood pressure thresholds, drug choices, and the role of guidelines and evidence-based medicine. *Arch Intern Med* 2000; 160:2281-2286.
17. Casiglia E, Zanette G, Mazza A, Donadon V, Donada C, Pizzoli A, et al. Cardiovascular mortality in non-insulin-dependent diabetes mellitus. A controlled study among 683 diabetics and 683 age- and sex-matched normal subjects. *Eur J Epidemiol* 2000; 16:677-684.
18. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. UK Prospective Diabetes Study Group. *BMJ* 1998; 317:703-713.
19. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green L A, Izzo JL Jr, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; 289:2560-2572.
20. Abbott K, Basta E, Bakris GL. Blood pressure control and nephroprotection in diabetes. *J Clin Pharmacol* 2004; 44:431-438.
21. Bosworth HB, Dudley T, Olsen MK, Voils CI, Powers B, Goldstein MK, et al. Racial differences in blood pressure control: potential explanatory factors. *Am J Med* 2006; 119:70 e9-15.
22. Eisner GM. Hypertension: racial differences. *Am J Kidney Dis* 1990; 16:35-40.
23. Seedat YK. Varying responses to hypotensive agents in different racial groups: black versus white differences. *J Hypertens* 1989; 7:515-518.
24. Fox JC, Leight K, Sutradhar SC, Demopoulos LA, Gleim GW, Lewin AJ, et al. The JNC 7 approach compared to conventional treatment in diabetic patients with hypertension: a double-blind trial of initial monotherapy vs. combination therapy. *J Clin Hypertens (Greenwich)* 2004; 6:437-442; quiz 43-44.
25. Jamerson K, Bakris GL, Dahlof B, Pitt B, Velazquez E, Gupte J, et al. Exceptional early blood pressure control rates: the ACCOMPLISH trial. *Blood Press* 2007; 16:80-86.
26. Neutel JM, Smith DH, Weber MA, Schofield L, Purkayastha D, Gatlin M. Efficacy of combination therapy for systolic blood pressure in patients with severe systolic hypertension: the Systolic Evaluation of Lotrel Efficacy and Comparative Therapies (SELECT) study. *J Clin Hypertens (Greenwich)* 2005; 7:641-646; quiz 7-8.
27. Moser M, Pickering T, Sowers JR. Combination Drug Therapy in the Management of Hypertension: When, With What, and How? *J Clin Hypertens (Greenwich)* 2000; 2:94-98.