Is hypertension well controlled in hypertensive diabetics

Daad H. Akbar, *FRCP, FACP,* ***Aisha A. Al-Ghamdi,*** *Arab Board, Saudi Board.*

ABSTRACT

Objectives: To determine the degree of blood pressure (BP) control in hypertensive diabetics and to study the types of antihypertensive agents used for BP control.

Methods: A cross-sectional study was carried out on hypertensive diabetics followed in the outpatient clinic of King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia from January 2000 to February 2001. Patient's age, sex, duration of diabetes and its control, duration of hypertension and the type of antihypertensive agents used, were noted. Patients were classified according to the degree of systolic and diastolic BP control into 4 groups: systolic group-I (≤120 mm Hg), group-II (121-130 mm Hg), group-III (131-140 mm Hg), group-IV (>140 mm Hg); diastolic group-I (≤80 mm Hg), group-II (81-85 mm Hg), group-III (86-90 mm Hg), group-IV (>90 mm Hg).

Results: A total of 230 patients were included with a mean age of 61 years and an equal male to female ratio. Mean duration of diabetes was 14 years and 9 years for hypertension. Five of 230 (2.2%) were in systolic group-I, 28/230 (12%) in group-II, 94/230 (41%) in group-III, 103/230 (44.8%) in group-IV; while 7/230 (3%) were in diastolic group-I, 30/230 (13%) in group-II, 92/230 (40%) in group-III, and 101/230 (43.9%) in group-IV. Angiotensin converting enzyme-inhibitors were used in 163/230 (70.9%) followed by diuretics in 99/230 (43%), Calcium channel-blockers in 62/230 (27%), and ß-blockers in 25/230 (10.9%).

Conclusion: Only a small percentage of hypertensive diabetics met the recommended BP for diabetics. Efforts should be made by both patients and physician to achieve better BP control.

Saudi Med J 2003; Vol. 24 (4): 356-360

Hypertension in diabetics is a common problem, and it constitutes one of the most rapidly increasing disorders in the world.[1,2] Hypertension doubles the already elevated risk of future cardiovascular events in diabetics.[3,4] Data from the recent United Kingdom prospective Diabetes Study (UKPDS) hypertension study[5,6] and the Hypertension Optimal Treatment (HOT) trial[7] demonstrated that aggressive lowering of diastolic blood pressure (BP) in diabetics to levels <85 mm Hg and 80 mm Hg, were accompanied by reduction of macrovascular events by one-third and one-half. The aim of our work is to determine the degree of BP control in hypertensive diabetics and to study the types of antihypertensive agents used to control the BP.

Methods. This study was conducted at King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia, (KSA) a teaching hospital in the West Coast of KSA. We included hypertensive diabetic patients being followed in the medical outpatient clinic from January 2000 to February 2001. Patients are followed with a mean follow-up period of 6-8 weeks depending on their blood pressure and blood glucose control. Hypertension was diagnosed as blood pressure >140/90, the patient is known hypertensive or receiving antihypertensive agents, with no obvious cause for secondary hypertension. The mean systolic and diastolic BP reading of the last 3 clinic visits were calculated. The following data was reported from the study group; age,

From the Department of Medicine, King Abdul-Aziz University Hospital, Jeddah, *Kingdom of Saudi Arabia*.

Received 2nd July 2002. Accepted for publication in final form 30th September 2002.

Address correspondence and reprint request to: Dr. Daad H. Akbar, PO Box 115652, Jeddah 21381, *Kingdom of Saudi Arabia*. Tel. +966 (5) 5604854. Fax. +966 (2) 6944856. E-mail: daadakb@yahoo.com

sex, duration of diabetes and its degree of control (good blood glucose control was defined as glycosylated hemoglobulin <8%, fasting blood glucose <8 mmol/l, 2 hours post-prandial blood glucose <11 mmol/l), duration of hypertension as well as the type of antihypertensive agents used. Patients were classified according to the degree of their systolic and diastolic BP control into 4 groups: systolic group-I (≤120 mm Hg), group-II (121-130 mm Hg), group-III (131-140 mm Hg), group-IV (>140 mm Hg) and diastolic group-I (≤80 mm Hg), group-II (81-85 mm Hg), group-III (86-90 mm Hg) group-IV (>90 mm Hg). The degree of BP control was determined, and comparison was made between the groups according to the type of antihypertensive agents used and the degree of blood glucose control.

The data was analyzed using the SPSS-9. The mean ± SD was determined for qualitative data, and frequency for categorical variables. Chi-square was used to analyze group differences for categorical variables, and a P value of <0.05 was considered significant.

Results. A total of 230 patients were included in the study with a mean age of 61 ± 11 years and equal male to female ratio. The mean duration of diabetes was 14 years (range 4 months to 40 years), 216/230 (93.9%) were poorly controlled. The mean duration of hypertension was 9.1 years (range 6 months to 39 years). Only a small percentage of patients had systolic and diastolic BP in group-I and II, in those angiotensin converting enzyme (ACE)-inhibitors was the most frequently used agent **(Tables 1, 2, 3)**. Almost half of the patients were using a single antihypertensive agent for BP control. Angiotensin converting enzyme inhibitors were the most frequently used agents followed by diuretics **(Table 4)**. Angiotensin converting enzyme-inhibitors were used as a single agent in 70/163 (42.9%) while 93/163 (57%) used it combined with other agent (p=0.01). Patients with systolic BP group-III and IV were more likely to be on combined antihypertensive agents compared to group-I and II, 35/94 (37.2%) and 55/103 (53.4%) versus 1/5 (20%) and 3/28 (11%) (p=0.01). The same was observed in patients with diastolic hypertension, 34/92 (37%) and 53/101 (52.5%) versus 1/7 (14.3%) and 3/30 (10%) (p 0.02). Patients with uncontrolled systolic and diastolic BP (group-III and IV) were more likely to have poorly controlled blood glucose **(Table 5)**.

Discussion. It has been reported that the prevalence of hypertension in diabetics varies from 39-46%.[8,9] Several studies showed that, compared to placebo, treatment of hypertension in type-2 diabetics prevents major clinical complications. Results from the Systolic Hypertension in the Elderly Program [SHEP][10] and Systolic Hypertension in Europe (Sys-Eur) trila,[11] favored the aggressive antihypertensive treatment of diabetics with isolated systolic hypertension. A review of 1137 hypertensive diabetics'[12] showed that only 21%

Table 1 - Degree of blood pressure control in 230 hypertensive diabetics.

Blood pressure	**Degree of control**			
Systolic BP	≤ 120 mm Hg	121-130 mm Hg	131-140 mm Hg	>140 mm Hg
n (%)	5 (2.2)	28 (12.2)	94 (40.9)	103 (44.8)
Diastolic BP	≤80 mm Hg	81-85 mm Hg	86-90 mm Hg	>90 mm Hg
n (%)	7 (3)	30 (13)	92 (40)	101 (43.9)

BP - blood pressure

Table 2 - Antihypertensive agents used in different systolic blood pressure groups*

Anti-hypertensive agents	**≤ 120 mm Hg N=5 n (%)**	**121-130 mm Hg N=28 n (%)**	**131-140 mm Hg N=94 n (%)**	**>140 mm Hg N=103 n (%)**
ACE-inh	3 (60)	20 (71.4)	66 (70.2)	74 (71.8)
β-blockers	-	3 (10.7)	10 (10.6)	12 (11.6)
Ca-blockers	2 (40)	5 (17.8)	20 (22.3)	35 (34)
Diuretics	2 (40)	11 (39.3)	42 (44.7)	44 (42.7)
Methyldopa	-	2 (7.1)	5 (5.3)	7 (6.8)
Prazosin	-	-	2 (2.1)	5 (4.8)

* some patients were using more than one agent, ACE-inh - angiotensin converting enzyme inhibitors, Ca blockers - calcium channel blockers β - beta

Table 3 - Antihypertensive agents used in different diastolic blood pressure groups*

Anti-hypertensive agents	**≤ 80 mm Hg N=7 n (%)**	**81-85 mm Hg N=30 n (%)**	**86-90 mm Hg N=92 n (%)**	**>90 mm Hg N=101 n (%)**
ACE-inh	5 (71.4)	22 (73.3)	63 (68.5)	73 (72.3)
β-blockers	-	3 (10)	9 (9.8)	13 (12.9)
Ca-blockers	2 (28.6)	5 (16.7)	19 (20.6)	36 (35.6)
Diuretics	2 (28.6)	11 (36.7)	41 (44.5)	45 (44.5)
Methyldopa	-	1 (3.3)	5 (5.4)	8 (7.9)
Prazosin	-	-	2 (2.2)	5 (4.9)

* some patients were using more than one agent, ACE-inh - angiotensin converting enzyme inhibitors, Ca blockers - calcium channel blockers β - beta

Table 4 - Type of antihypertensive agents used for blood pressure control* (N=230).

Antihypertensive agent	n	(%)
ACE -inhibitors	163	(70.9)
β-blockers	25	(10.9)
Ca-blockers	62	(27)
Diuretics	99	(43)
Methyldopa	14	(6.1)
Prazosin	7	(3)

* some patients were on combined antihypertensive agents
ACE - angiotensin converting enzyme
Ca-blockers - calcium channel blockers

Table 5 - Relation of blood pressure control to blood glucose control*.

Blood pressure	Degree of control	
Systolic	131-140 mm Hg N=94 n (%)	>140 mm Hg N=103 n (%)
Controlled blood glucose	7 (7.4)	4 (3.9)
Uncontrolled blood glucose	87 (92.5)	99 (96.1)
Diastolic	86-90 mm Hg N=92 n (%)	>90 mm Hg N=101 n (%)
Controlled blood glucose	6 (6.5)	5 (4.9)
Uncontrolled blood glucose	86 (93.5)	96 (95)

*P value for systolic BP = 0.14
P value for diastolic BP = 0.2

of them met the currently recommended BP for diabetics of <130/85 mm Hg. A lower frequency was noted in our study where only 2% had systolic BP of <120 mm Hg, 12% between 121-130 mm Hg and 3% had diastolic BP ≤80 mm Hg, 13% between 81-85 mm Hg. Angiotensin converting enzyme-inhibitors were found to be the most frequently used antihypertensive agent followed by diuretics. Recent comparative trials have suggested that for the prevention of cardiovascular events, ACE-inhibitors may be superior to alternative antihypertensive agents.[13,14] The cumulative results of 3 trials, the Appropriate Blood Pressure Control in Diabetes [ABCD],[15] the Captopril Prevention project [CAPPP],[16,17] and the Fosinopril versus Amlodipine Cardiovascular Events Randomized Trial [FACET][18] showed a significant benefit of ACE-inhibitors on the outcome of acute myocardial infarction (63% reduction, p<0.001), cardiovascular events (51% reduction, p<0.001), and all-cause mortality (62% reduction, p=0.01).[19] Results of the Heart Outcome Prevention Evaluation [HOPE] study[20,21] showed that reduction of cardiovascular events with ACE-inhibitors was much greater than that expected for BP reduction alone compared with placebo, which supports the view that additional mechanisms may contribute to the prevention of cardiovascular events with ACE-inhibitors. These mechanisms are; improvement of whole-body glucose uptake,[22] improvement of endothelial dysfunction,[23] reduction of inflammation,[24] promotion of fibrinolysis[25,26] attenuation of sympathetic nerve activity[27] and improvement in coronary reserve.[28] Angiotensin converting enztme-inhibitors have favorable effects not only on cardiovascular events but also on renal and quality of life as compared with other regimens.[29-31] Therefore, it may be considered as the first line agent in hypertensive diabetics. The guidelines for the management of hypertension issued by the World Health Organization (WHO), recommend ACE-inhibitors along with diuretics, β-blockers, calcium-channel blockers and angiotensin receptor II antagonist as suitable first line agents.[32] However, in the absence of renal disease, diuretics and β-blockers can be used as initial therapy as recorded by the 6th Joint National Committee in United States of America.[33] There was under use of beta-blockers in our study. Physicians may be reluctant to treat diabetics with beta-blockers due to they are afraid of masking hypoglycemic symptoms. Many studies had confirmed the benefits of beta-blockers in diabetics.[34,35] In a prospective study of therapy of hypertension in diabetics; the incidence of hypoglycemia were similar on captopril and atenolol group.[36] As shown in our study and others[12] only small percentage of hypertensive diabetics met the recommended BP goal of <130/85 mm Hg. The greatest block for good BP control is non-compliance. The Canadian Coalition for Blood Pressure Control[37] reported non-compliance rate of 50%. Non-adherence is the major cause of treatment failure. Patients seen in our hospital are of low to moderate income and education. They may have poor insight into this dangerous chronic asymptomatic disease; they may feel well and so they are not motivated to adhere to daily medication regimen. They may get fed up from taking long time medication for their BP and blood glucose control. We observed that the mean duration of hypertension and diabetes is 9 and 14 years, and most of the patients with uncontrolled hypertension have poorly controlled blood glucose. Another reason for poor compliance is inability to afford the medications. Compliance of the patients, in addition to their education

regarding their disease and it's significance through media and possible supply of medications, depends in a large part on the confidence the patients have in their physicians. A major factor in gaining this confidence is to achieve goal BP promptly and efficiently. A recent survey showed that 82% of physicians failed to raise doses of medications when indicated.[38] Physician's education with regards to the importance of BP control promptly and efficiently should be considered.

References

1. Epstein M, Sowers JR. Diabetes mellitus and hypertension. ***Hypertension*** 1992; 19: 403-418.
2. Weidmann P, Boehlen LM, De Courten M. Pathogenesis and treatment of hypertension associated with diabetes mellitus. ***Am Heart J*** 1993; 125:1498-1513.
3. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12 year cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. ***Diabetes Care*** 1993; 16: 434–444.
4. The Hypertension in Diabetes Study Group. Hypertension in Diabetes Study (HDS). II. Increased risk of cardiovascular complications in hypertensive type 2 diabetic patients. ***J Hypertens*** 1993; 11: 319–325.
5. UK Prospective Diabetes Study Group. Tight blood pressure and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. ***BMJ*** 1998; 317: 703-713.
6. UK Prospective Diabetes Study Group. Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39. ***BMJ*** 1998; 317: 713–720.
7. Hansson L, Zanchetti A, Carruthers SG, Dahlöf B, Elmfelt D, Julius S et al. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomised trial. ***Lancet*** 1998; 351: 1755–1762.
8. The Hypertension in Diabetes Study Group. Hypertension in Diabetes Study (HDS): I. Prevalence of hypertension in newly presenting type-2 diabetic patients and the association with risk factors for cardiovascular and diabetic complications; II. Increased risk of cardiovascular complications in hypertensive type-2 diabetic patients. ***J Hypertens*** 1993; 11: 309-319.
9. Akbar D. Is hypertension common in hospitalized type-2 diabetic patients? ***Saudi Med J*** 2001; 22: 139-141.
10. Curb JD, Pressel SL, Cutler JA, Savage PJ, Applegate WB, Black H et al. Effect of diuretic-base antihypertensive treatment on cardiovascular disease risk in older diabetic patients with isolated systolic hypertension: Systolic Hypertension in Elderly Program Cooperation Research Group. ***JAMA*** 1996; 76: 1886-1892.
11. Tuomilehto J, Rastenyte D, Birkenhager WH, Thijs L, Antikainen R, Bulpitt CJ et al. Effects of calcium-channel blockade in older patients with diabetes and systolic hypertension. ***N Eng J Med*** 1999; 340: 677-684.
12. Maue SK, Farrelly EW, Frech F. The need for improved blood pressure control within the diabetic hypertensive population. Program and abstracts of the 61st Scientific Sessions of the American Diabetes Association; 2001 June 22-26, Philadelphia (PA): United States of America. ***Diabetes*** 2001; 50 (Suppl 2): Abstract 12.LB
13. Pahor M, Psaty BM, Furberg CD. Treatment of hypertensive patients with diabetes. ***Lancet*** 1998; 351: 689-690.
14. Pahor M, Psaty BM, Furberg CD. New evidence on the prevention of cardiovascular events in hypertensive patients with type-2 diabetes. ***J Cardiovasc Pharmacol*** 1998; 32 (Suppl 2): S18-S23.
15. Estacio RO, Jeffers BW, Hiatt WR, Biggerstaff SL, Gifford N, Schrier RW. The effect of nisoldipine as compared with enalapril on cardiovascular outcomes in patients with non-insulin dependent diabetes and hypertension. ***N Engl J Med*** 1998; 338: 645–652.
16. Hansson L, Hedner T, Lindholm L, Niklason A, Luomanmäki K, Niskanen L et al. The Captopril Prevention Project (CAPPP) in hypertension. Baseline data and current status. ***Blood Press*** 1997; 6: 365–367.
17. Hansson L, Lindholm LH, Niskanen L, Lanke J, Hedner T, Niklason A et al. Effect of angiotensin-converting-enzyme inhibition compared with conventional morbidity and mortality in hypertension: the Captopril Prevention Project (CAPPP) randomised trial. ***Lancet*** 1999; 353: 611–616.
18. Tatti P, Pahor M, Byington RP, Di Mauro P, Guarisco R, Strollo G et al. Outcome results of the Fosinopril Versus Amlodipine Cardiovascular Events Randomized Trial (FACET) in patients with hypertension and NIDDM. ***Diabetes Care*** 1998; 1: 597–603.
19. Pahor M, Psaty B, Alderman M, Applegate W, Williamson J, Furberg C. Therapeutic benefits of ACE inhibitors and other antihypertensive drugs in patients with type-2 diabetes. ***Diabetes Care*** 2000; 23: 888-892.
20. The Heart Outcomes Prevention Evaluation Study Investigators. Effects of an angiotensin-converting enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. ***N Engl J Med*** 2000; 342:145–153.
21. Heart Outcomes Prevention Evaluation Study Investigators. Effects of ramipril on cardiovascular outcomes in people with diabetes mellitus: results of the HOPE study and MICRO-HOPE substudy. ***Lancet*** 2000; 355: 253–259.
22. Pollare T, Lithell H, Berne C. A comparison of the effect of hydrochlorothiazide and captopril on glucose and lipid metabolism in patients with hypertension. ***N Engl J Med*** 1989; 321: 868–873.
23. Mancini GBJ, Henry GC, Macaya C, O'Neill BJ, Pucillo AL, Carere RG et al. Angiotensin-converting enzyme inhibition with quinapril improves endothelial vasomotor dysfunction in patients with coronary artery disease. ***Circulation*** 1996; 94: 258–265.
24. Schindler R, Dinarello CA, Koch KM. Angiotensin converting enzyme inhibitors suppress synthesis of tumour necrosis factor and interlukin I by human peripheral blood mononuclear cells. ***Cytokine*** 1995; 7: 526-533.
25. Oshima S, Ogawa H, Mizuno Y, Yamashita S, Noda K, Saito T et al. The effects of the angiotensin converting enzyme inhibitor imidapril on plasma plasminogen activator inhibitor activity in patients with acute myocardial infarction. ***Am Heart J*** 1997; 134: 961-966.
26. Vaughan DE, Rouleau JL, Ridker PM, Arnold JM, Menapace FJ, Pfeffer MA. Effects of ramipril on plasma fibrinolytic balance in patients with acute anterior myocardial infarction: Heart Study Investigators. ***Circulation*** 1997; 96: 442-447.
27. Giannattasio C, Cattaneo BM, Omboni S, Seravalle G, Bolla G, Turolo L et al. Sympathomoderating influence of benazepril in essential hypertension. ***J Hypertens*** 1992; 10: 373–378.
28. Motz W, Strauer BE. Improvement of coronary flow reserve after long-term therapy with enalapril. ***Hypertension*** 1996; 27: 1031–1038.
29. Lewis EJ, Hunsicker LG, Bain RP, Rohde RD, for the Collaborative Study Group: The effect of angiotensin-converting-enzyme inhibition on diabetic nephropathy. ***N Engl J Med*** 1993; 329: 1456–1462.
30. Giatras I, Lau J, Levey AS, for the Angiotensin-Converting-Enzyme Inhibition and Progressive Renal Disease Study Group. Effect of angiotensin-converting enzyme inhibitors on the progression of nondiabetic renal disease: a meta-analysis of randomized trials. ***Ann Intern Med*** 1997; 127: 346–355.
31. Croogh SH, Levine S, Testa MA, Brown B, Bulpitt CJ, Jenkins CD et al. The effects of antihypertensive therapy on the quality of life. ***N Engl J Med*** 1984; 314: 1657-1664.

32. Guidelines Subcommittee: World Health Organization/International Society of Hypertension. Guidelines for the management of hypertension. ***J Hypertens*** 1999; 17: 151–183.
33. The Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VI). ***Arch Intern Med*** 1997; 157: 2413–2446.
34. Giugliano D, Acampora R, Marfella R, De Rosa H, Ziccardi P, Ragone R et al. Metabolic and cardiovascular effects of carvedilol and atenolol in non-insulin dependent diabetes mellitus and hypertension: A randomized, controlled trial. ***Ann Intern Med*** 1997; 126: 955-959.
35. Tse WY, Kendall M. Is there a role for Beta-blockers in hypertensive diabetics? ***Diabet Med*** 1994; 11: 137-144.
36. Hypertension in diabetes study III. Prospective study of therapy of hypertension in type-2 diabetic patients: efficacy of ACE inhibition and beta-blockade. ***Diabet Med*** 1994; 11: 773-782.
37. Chockalingam A, Bacher M, Campbell N, Cutler H, Drover A, Feldman R et al. Adherence to management of high blood pressure: recommendations of the Canadian Coalition for High Blood Pressure Prevention and Control. ***Can J Public Health*** 1998; 89: I5-I11.
38. Sever PS. Blood pressure control for the hypertensive patient: what can we do better? ***Am J Hypertens*** 1987; 10: 285-1291.

Related Abstract
Source: Saudi MedBase

Saudi MedBase CD-ROM contains all medical literature published in all medical journals in the Kingdom of Saudi Arabia. This is an electronic format with a massive database file containing useful medical facts that can be used for reference. Saudi Medbase is a prime selection of abstracts that are useful in clinical practice and in writing papers for publication.

Search Word: diabetes mellitus

Author: Hisham Mahaba

Institute: Ain Shams University, Cairo, Egypt

Title: Prevalence of diabetes mellitus and hypertension in relation to chemical composition of drinking water: Does magnesium protect against diabetes mellitus?

Source: Saudi Med J 1998; 19: 469-474

Abstract

Objective: This study was conducted to compare between the prevalence of diabetes and hypertension, and chemical composition of drinking water, mainly magnesium and calcium. **Methods:** A cross sectional study was conducted at Hail region, Saudi Arabia during the year 1416 hijra. The prevalence of cases of hypertension and diabetes at all primary health care centers, was compared with chemical constituents of samples of available drinking waters. **Results:** A total prevalence of 1.77% for diabetes mellitus and 2.1% for hypertension was found. A statistically significant negative correlation was found between levels of magnesium, dissolved salts, alkalinity, chloride contents and the prevalence of diabetes mellitus at all ages. While no significant correlation was found between calcium contents and diabetes mellitus. On the other hand, no statistically significant correlation could be found between any of these chemicals and the prevalence of hypertension. **Conclusion:** These results suggest a prophylactic role for magnesium against diabetes mellitus.