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ORIGINAL ARTICLE

Prevalence of Diabetes Mellitus in Outpatients with Essential Hypertension in a Rural Tertiary Hospital

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Abstract

Objective: To determine the prevalence of diabetes mellitus (DM) in patients with essential hypertension attending outpatient medical clinic in a rural community setting of a developing country.

Methods: This cross-sectional study included patients of a medical outpatient clinic in Federal Teaching Hospital Ido Ekiti, Ekiti State, Nigeria. Study patients were consecutively recruited from Cardiac clinic and baseline investigations obtained from the patients' files were evaluated including Fasting Blood Glucose (FBG).The estimated minimum sample size was 80 with probability of type 1 error, assumption of $\alpha = 0.05$ and power of 95%. A total of 160 patients with the minimal number of investigation results were included.

Results: The 160 patients (76 male and 84 female) had a mean age (± standard deviation) of 64.6 ± 12.4 years (range, 40-88 years). The majority of the participants (50%) were aged 60-79 years. Diabetes was present in 25.7% ($p < 0.001$) of cases of hypertension with FBG test. Most of the patients (89.5%) were of low income earnings.

Conclusion: Our findings showed a high prevalence of DM among hypertensive outpatients in rural and low income setting.

Keywords

Diabetes, Hypertension, Prevalence, Rural, Outpatient

Introduction

Hypertension and diabetes mellitus (DM) are prevailing at an epidemic proportion throughout the world [1-3]. This is partly due to continuous change in lifestyle that favours the development of the conditions [4-7]. This co-morbidity has markedly increased the risk of cardiovascular disease (CVD) [8,9].

Diabetes is the commonest co-morbidity of hypertension. These diseases exert huge burden of demands on individuals, families, communities and the health system of any country. Research had shown that people with elevated blood pressure are at increased risk of diabetes [10].

Cardiovascular disease is at least two times more frequent in hypertensive patients with DM than in those with hypertension alone [11-15]. Early detection and treatment of DM in hypertensive patients may be particularly important to reduce the risk of developing cardiovascular complications, which may further lead to increase in morbidity and mortality rates [1].

The prevalence of hypertension depends upon the definition of hypertension. The prevalence data presented in this paper should be interpreted according to the definition of hypertension at the time the study was done unless otherwise stated.

An estimated 1.13 billion people worldwide have hypertension, most (two-thirds) living in low- and middle-income countries [2]. In Nigeria hypertension is estimated to be 28.9% [16].

Studies in Nigeria have reported that the preva-

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lence of diabetes varies across different zones of the country but ranges from 2.2-9.8% [17-20]. The diabetes statistics of the International Diabetic Federation (IDF) showed that Nigeria has the highest number of people living with diabetes and impaired fasting glucose (IFG) in Africa [21].

However, there are scarce data on prevalence of diabetes in patients with hypertension in Nigeria. To the best of the authors' knowledge, no available data for rural tertiary hospital. Few data available are studies on prevalence of the co-morbidity especially from urban tertiary health centres [22,23]. Therefore, we sought to determine the prevalence of diabetes in adult hypertensives attending Medical Outpatient Clinic in a tertiary hospital located in a rural setting.

Methods

Study subjects and design

This study was a cross-sectional study on hypertensive outpatients with no identifiable secondary cause in a Federal Teaching Hospital Ido Ekiti, Ekiti State, Nigeria; located in a rural community of Ekiti state in Nigeria. We used non-randomised convenience sampling technique. Eligible patients were consecutively recruited in the study.

The inclusion criteria for enrolment include all patients that had undergone hypertension treatment attending the clinic during the period of study and aged more than 20 years. Patients with incomplete data were excluded and 160 patients were included in the final analysis.

Data collection

Information were obtained from the patients' files by the senior resident physicians between year 2017-2018 which included demographic characteristics, blood pressure (BP), fasting blood glucose, smoking status, duration of hypertension, history of DM, anthropometric measurement and other relevant information.

Documented data in the case file were obtained in our clinic by standardized method. Weights (kg) were measured by standardized techniques and equipment [24]. Blood pressure was measured with a mercury sphygmomanometer at least twice in each participant with at least five minutes of rest in between, with the subject seated in a chair and relaxed, the back supported, and the arm at heart level. During the initial screening, BP of both arms was measured with mercury sphygmomanometer and the arm with higher BP used subsequently. Fasting blood glucose and fasting lipid profile were determined using venous blood by conventional laboratory devices after an overnight fast.

Definitions

The following definitions were adopted for this study. Hypertension: Persistently elevated blood pressure (BP) ≥ 140/90 mmHg, based on at least two readings on separate occasions after the initial screening [25]. The choice of 140/90 mmHg as a cut-off point is based on the Seventh Report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC 7) criteria [25]. Diabetes mellitus: Diagnosed according to the World Health Organization diagnostic criteria [26].

Dyslipidaemia: National Cholesterol Education Programme Adult Treatment Panel III (NCEP ATP III) cut-off points were used to identify participants with desirable, borderline high and high levels of lipoprotein risk factors [27]. Smoking and alcohol: Considered present if reported up to the day of the interview. Metabolic syndrome was defined according to WHO definition [28].

Sample size estimation

There is no national data for prevalence of DM among hypertensive patients. Therefore, we estimated the sample size based on average prevalence of 6% for DM for the Nigerian general population [17-20]. The estimated minimum sample size was 80 with probability of type 1 error, assumption of $\alpha = 0.05$ and power of 95%.

Statistical analysis

Categorical variables were represented as number (percentage) and were compared by χ^2 test. Continuous variables were represented as the mean (SD) in case of normal distribution, and were otherwise presented as medians. A p value less than 0.05 was considered as statistically significant. Ethics and research committee approval from the institution was obtained. Data were managed and analysed using SPSS for windows version 16 (SPSS Inc. Chicago, Illinois, USA).

Results

A total of 160 patients entered the final analysis. Only 136 could afford to do FBG; 86 did TC and HDL; and 84 did LDL. There were 76 males (47.5%) and 84 females (52.5%) with an average age of 64.6 ± 12.4 years. Majority of the patients were low income earners (60.7%): petty traders, 23.8%; retirees, 22.5%; peasant farmers, 14.4%. Table 1 provided further summary of the baseline characteristics.

In hypertensive outpatients in this study, the prevalence of DM was 25.7%, higher in males (15.4%) than females (10.3%) as shown in Table 2. The table further shows that the prevalence of DM was high in patients with metabolic syndrome (61.5%) and increased with duration of hypertension from 24.1% in those of less than 5 years duration to 32% in those of equal or greater than 10 years. This trend was significant, p value less than 0.005.

Table 1: Baseline characteristics of the study hypertensive outpatients.

Characteristics	Total (n = 160)
Age, years, mean (SD)	64.6 (12.4)
Gender, male (%)	76 (47.5)
SBP at presentation, mmHg, mean (SD)	161.0 (27.4)
DBP at presentation, mmHg, mean (SD)	92.9 (15.3)
FBG (n = 136), mmol/L, mean (SD)	6.3 (3.4)
Weight (n = 153), Kg, mean (SD)	70 (11.6)
Duration of hypertension, median (IQR)	4 (2-10)
Age group (years)	
≤ 44, n (%)	12 (7.5)
45-64, n (%)	68 (42.5)
≥ 65, n (%)	80 (50)
Occupation, n (%)	
Trader	38 (23.8)
Retirees	36 (22.5)
Others	28 (17.5)
Farmer	23 (14.4)
Unclassified	17 (10.6)
Teacher	14 (8.8)
Clergy	4 (2.5)
Lipid Panel, mmol/L, mean (SD)	
Total Cholesterol (n = 86)	4.6 (1.4)
High Density Lipoprotein (n = 86)	1.4 (0.1)
Low Density Lipoprotein (n = 84)	2.7 (1.4)
Triglyceride	1.2 (0.6)

Data are expressed as number, n (per cent) for categorical variables, as mean (SD, standard deviation) for continuous variables in case of normal distributions and medians (IQRs, Inter Quartile Ranges) otherwise. SBP: systolic blood pressure; DBP: diastolic blood pressure; FBG: Fasting Blood Glucose.

Figure 1 shows a progressive increase in prevalence of hypertension and hypertensive diabetic with age. In both clinical conditions, there was a fall in prevalence in females of more than 65 years compared to 45-65 years of age.

Discussion

This study revealed a high prevalence of DM among medical outpatients with hypertension (25.7%) in a tertiary hospital situated in a rural community. This finding is similar to that reported in other studies done in urban centres [29-31].

However, the prevalence of DM in this study (25.7%) among hypertensive patients receiving treatment is much higher than newly diagnosed DM (2.2-9.8%) wi-

Table 2: Detection rates of diabetes in hypertensive outpatients.

Characteristics	Number	Prevalence n (%)
Total FBG	136	35 (25.7)**
Gender		
Male	65	21 (15.4)
Female	71	14 (10.3)
Metabolic syndrome	13	8 (61.5)**
Duration of hypertension		
< 5 years	58	14 (24.1)
5-9 years	18	5 (27.8)
≥ 10 years	25	8 (32)
Alcohol intake	70	11 (15.7)*
Cigarette smoking	74	12 (16.2)

Data are expressed as number, n (per cent) for all the categorical variables. FBG: Fasting Blood Glucose. Data are presented as number (per cent). Data were compared by χ^2 test. *p < 0.05; **p < 0.01.

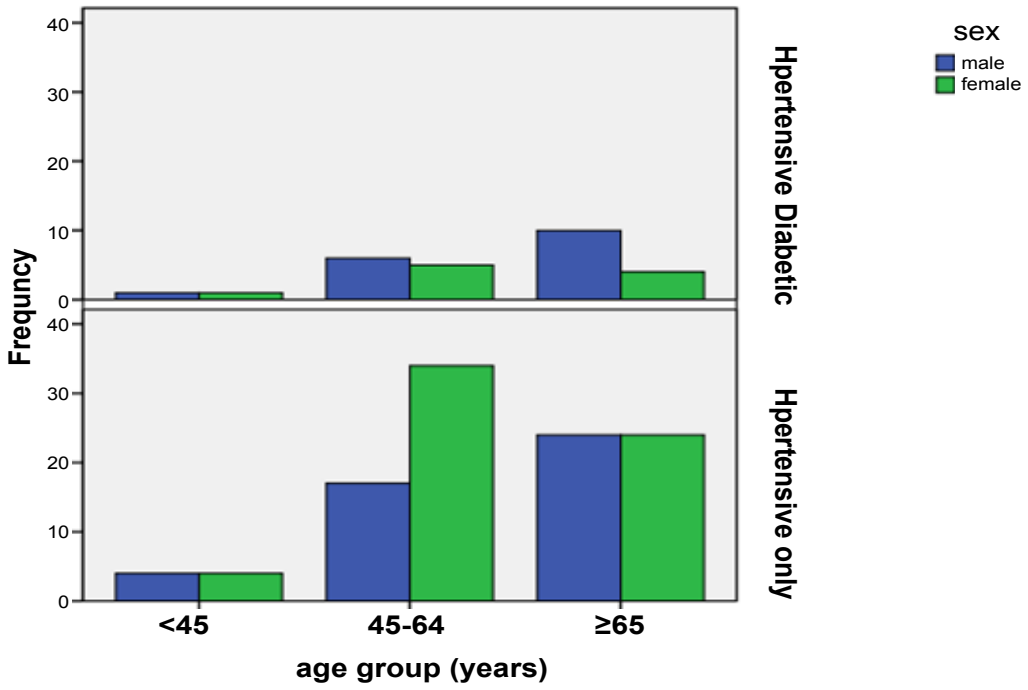

Figure 1: Sex and age distribution of hypertensive patients with and without diabetes mellitus.

thout hypertension in the study done across different zones of the country [17-20]. It is worthy of note that in this study, the longer the duration of hypertension the higher the prevalence of diabetes. These further established the fact that hypertension is a factor in the development of DM [14,32]. In addition, these evidences suggest that the strengthening of DM screening among patients with hypertension is crucial beyond initial screening for DM at diagnosis of hypertension.

Nevertheless, the study population is predominantly elderly as expected in age distribution for hypertension and diabetes [33-35]. In addition, rural populations are predominantly old population because of rural to urban migration [36]. The middle aged showed higher female gender prevalence of hypertension alone in this study compared to the elderly contrary to the established gender distribution [33]. This may not be unconnected with some published observations in South-West Nigeria and other parts of the world that females have better health seeking behaviour than males [37,38]. It has also been anecdotally found that mothers tend to get more attention from their children than the fathers hence, better health care.

The patients were predominantly low income earners. This is a triple tragedy of poverty, diabetes, and hypertension for these individuals to cope with. More so, the low income earning might have affected their treatment compliance in terms of affordability. This might have partly resulted into the observed high mean value of BP and sub-optimal mean value of FBG despite treatment. The outcome of such situation will be high morbidity and mortality in a rural setting of this nature.

There was a progressive increase in prevalence of hypertensive diabetic or hypertension alone with age as previously reported [33-35]. This was only observed in male unlike in female with a fall in prevalence for both clinical conditions in the elderly compared to the middle aged. The aforementioned health seeking behaviour of females and the generous care commonly received by aged mothers from their children unlike the aged fathers noted in this part of the world may partly be responsible for this observation.

However, there was no difference in gender distribution for young adults in both hypertensive-diabetic and hypertension alone. Similarly, there was no gender difference in the elderly for hypertension alone. These results agree with recent data [39,40].

Epidemiologic studies provide evidence for co-existence of hypertension and diabetes and possibly point towards a common genetic and environmental factor promoting both diabetes and hypertension [41]. Similarly, clustering of hypertension, insulin resistance or type 2 diabetes, hyperlipidaemia and central obesity have been documented in several populations [41]. Insulin resistance, increased tissue inflammation and reactive oxygen species (ROS) production resulting in endothelial dysfunction, increased tissue renin- angiotensin-aldosterone system (RAAS) and increased sympathetic nervous system activity have all been implicated in this complex pathophysiology of diabetes and hypertension.

It is estimated that about 25-47% of persons with hypertension have insulin resistance or impaired glucose tolerance [42]. With insulin resistance, there are impaired biological and physiological tissue responses to insulin. The relationship of insulin resistance, diabetes and hypertension is complex and interrelated. Untreated patients with essential hypertension have higher fasting and postprandial insulin levels than age- and sex-matched normotensive persons, regardless of body mass; a direct correlation between plasma insulin levels and BP exists [43,44]. Interestingly, the relationship between hyperinsulinaemia and hypertension is not seen in secondary hypertension [44]. This indicates that insulin resistance and hyperinsulinaemia are not consequences of hypertension, but rather a genetic predisposition that acts as a fertile soil for both diseases. This notion is supported by the observation that there is abnormal glucose metabolism in the offspring of hypertensive parents [44,45]. Thus, there is a strong association between hypertension, diabetes and insulin resistance. There is also a strong association between upregulation of RAAS, hypertension and diabetes [46-48]. This upregulation of RAAS results in enhanced generation of ROS and may explain impaired glucose utilisation as well as hypertension associated with insulin resistance and type 2 diabetes [49].

The potential limitations of this study require consideration. First, our sample consists of those referred to specialist clinic therefore may not reflect the status of those in the general population.

Second, two hours postprandial glycemic values were not considered in this study; hence, the actual prevalence might be underestimated. Third, the exact onset of DM could not be ascertained in some of the patients; hence, this favors a potential overestimation. Fourth, no consideration given to patients with impaired fasting glucose for definitive diagnosis with the use of oral glucose tolerance test, which may underestimate or overestimate the prevalence of DM.

In conclusion, our findings demonstrate that 25.7% of hypertensive outpatients had concomitant DM and the longer the duration of hypertension the higher the prevalence. Virtually all the patients were of low income status. This finding in a rural setting demands urgent deployment of health insurance scheme to ensure access to optimal health care. This will reduce potential morbidity and mortality.

References

1. Mohan V, Seedat YK, Pradeepa R (2013) The rising bur-

den of diabetes and hypertension in Southeast Asian and African regions: Need for effective strategies for prevention and control in primary health care settings. Int J Hypertens.

2. https://www.who.int/news-room/fact-sheets/detail/hypertension.

3. International Diabetes Federation (IDF) (2012) Country estimates table 2011. (6th edn), IDF diabetes atlas.

4. Wassertheil-Smoller S, Blaufox MD, Oberman AS, Langford HG, Davis BR, et al. (1992) The Trial of Antihypertensive Interventions and Management (TAIM) study. Adequate weight loss, alone and combined with drug therapy in the treatment of mild hypertension. Arch Intern Med 152: 131-136.

5. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, et al. (2001) Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. N Engl J Med 344: 3-10.

6. Halbert JA, Silagy CA, Finucane P, Withers RT, Hamdorf PA (1999) Exercise training and blood lipids in hyperlipidemic and normolipidemic adults: A meta-analysis of randomized, controlled trials. Eur J Clin Nutr 53: 514-522.

7. Whelton SP, Chin A, Xin X, He J (2002) Effect of aerobic exercise on blood pressure: A meta-analysis of randomized, controlled trials. Ann Intern Med 136: 493-503.

8. Sowers JR (2004) Treatment of hypertension in patients with diabetes. Arch Intern Med 164: 1850-1857.

9. El-Atat F, McFarlane SI, Sowers JR (2004) Diabetes, hypertension, and cardiovascular derangements: Pathophysiology and management. Curr Hypertens Rep 6: 215-223.

10. Connor A Emdin, Simon G Anderson, Mark Woodward, Kazem Rahimi (2015) Usual blood pressure and risk of new-onset diabetes: Evidence from 4.1 million adults and a meta-analysis of prospective studies. J Am Coll Cardiol 66: 1552-1562.

11. Hirose H, Saito I (2003) Trends in blood pressure control in hypertensive patients with diabetes mellitus in Japan. Hypertens Res 26: 717-722.

12. Conen D, Ridker PM, Mora S, Buring JE, Glynn RJ (2007) Blood pressure and risk of developing type 2 diabetes mellitus: The women's health study. Eur Heart J 28: 2937-2943.

13. American Diabetes Association (2004) Hypertension management in adults with diabetes. Diabetes Care 27: S65-S67.

14. (1994) National High Blood Pressure Education Program Working Group report on hypertension in diabetes. Hypertension 23: 145-158.

15. Gress TW, Nieto FJ, Shahar E, Wofford MR, Brancati FL (2000) Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. Atherosclerosis Risk in Communities Study. N Engl J Med 342: 905-912.

16. Adeloye D, Basquill C, Aderemi AV, Thompson JY, Obi FA (2015) An estimate of the prevalence of hypertension in Nigeria: A systematic review and meta-analysis. J Hypertens 33: 230-242.

17. Akinkugbe OO (1997) Non communicable diseases in Nigeria: National survey (final report) on hypertension, coronary heart disease, diabetes mellitus, G6PD deficiency and anaemia. National Expert Committee on Non-Communicable Disease. Federal Ministry of Health and Social Services, Lagos, 1-12.

18. Chinenye S, Ogbera AO (2013) Socio-cultural aspects of diabetes mellitus in Nigeria. J Soc Health Diabetes 1: 15-21.

19. Omorogiuwa A, Oaikhena GA, Okioya P, Akubueze D, Owobu E, et al. (2010) Diabetes mellitus: Prevalence amongst University staff in Southern Nigeria and attitude towards routine glycemic/glucosuric checkup. Int J Biomed & Hlth Sci 6: 25-29.

20. Nyenwe EA, Odia OJ, Ihekwaba AE, Ojule A, Babatunde S (2003) Type 2 diabetes in adult Nigerians: A study of its prevalence in Port Harcourt, Nigeria. Diabetes Res Clin Pract 62: 177-185.

21. International Diabetes Federation Diabetes Fact Sheet.

22. Isara AR, Okundia PO (2015) The burden of hypertension and diabetes mellitus in rural communities in southern Nigeria. Pan Afr Med J 20: 103.

23. Beatrice Ohunene Bello-Ovosi, Sunday Asuke, Shehu Ozovehe Abdulrahman, Muhammed Sani Ibrahim, Joseph Ogirima Ovosi, et al. (2018) Prevalence and correlates of hypertension and diabetes mellitus in an urban community in North-western Nigeria. Pan Afr Med J 29: 97.

24. National Health and Nutrition Examination Survey (2000) Body composition procedures manual.

25. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, et al. (2003) The Seventh Report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure: The JNC 7 Report. JAMA 289: 2560-2572.

26. American Diabetes Association (2010) Diagnosis and classification of diabetes mellitus. Diabetes Care 33: S62-S69.

27. (2001) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults: National Cholesterol Education Programme: Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol (Adult Treatment Panel III). JAMA 285: 2486-2497.

28. Albert KG, Zimmet PZ (1998) Definition, diagnosis and classification of diabetes mellitus and its complication. Part 1: Diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet Med 15: 539-553.

29. Liu J, Zhao D, Liu J, Qi Y, Sun J, et al. (2013) Prevalence of diabetes mellitus in outpatients with essential hypertension in China: A cross-sectional study. BMJ Open 3: e003798.

30. Yi YJ, Ran X, Huang XB, Liu Y, Zhang TJ, et al. (2010) An epidemiological study of abnormal glucose metabolism and its risk factors among middle and aged population with hypertension in Chengdu area. Zhonghua Nei Ke Za Zhi 49: 301-304.

31. García-Puig J, Ruilope LM, Luque M, Fernández J, Ortega R, et al. (2006) Glucose metabolism in patients with essential hypertension. Am J Med 119: 318-326.

32. Sowers JR, Epstein M (1995) Diabetes mellitus and associated hypertension, vascular disease and nephropathy. An update. Hypertension 26: 869-879.

33. Burt VL, Whelton P, Roccella EJ, Brown C, Cutler JA, et al. (1995) Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey, 1998-1991. Hypertension 25: 305-313.

34. Centres for Disease Control and Prevention (2017) National Diabetes Statistics Report, 2017.

35. Harrison P (2017) Almost half the US population has diabetes or its precursor. Medscape Medical News.

36. Ajaero CK, Onokala PC (2013) The Effects of Rural-Urban Migration on Rural Communities of South-Eastern Nigeria. International Journal of Population Research 2013: 10.

37. Ashley E Thompson, Yvonne Anisimowicz, BaukjeMiedema, William Hogg, Walter P Wodchis, et al. (2016) The influence of gender and other patient characteristics on health care-seeking behaviour: A QUALICOPC study. BMC Fam Pract 17: 38.

38. OA Akintaro (2015) Health seeking behaviours as predictors of hypertension among traders in Osun State, Nigeria. Huria Journal 20: 1.

39. Sarki AM, Nduka CU, Stranges S, Kandala NB, Uthman OA (2015) Prevalence of hypertension in low- and middle-income countries: A systematic review and meta-analysis. Medicine (Baltimore) 94: e1959.

40. Danaei G, Singh GM, Paciorek CJ, Lin JK, Cowan MJ, et al. (2013) The global cardiovascular risk transition: Associations of four metabolic risk factors with national income, urbanization, and Western diet in 1980 and 2008. Circulation 127: 1493-1502.

41. Reaven GM (1988) Role of insulin resistance in human disease. Diabetes 37: 1595-1607.

42. Lind L, Berne C, Lithell H (1995) Prevalence of insulin resistance in essential hypertension. J Hypertens 13: 1457-1462.

43. Sowers JR, Epstein M, Frohlich ED (2001) Diabetes, hypertension, and cardiovascular disease: An update. Hypertension 37: 1053-1059.

44. Sechi LA, Melis A, Tedde R (1992) Insulin hypersecretion: A distinctive feature between essential and secondary hypertension. Metabolism 41: 1261-1266.

45. Sowers JR, Bakris GL (2000) Antihypertensive therapy and the risk of type 2 diabetes mellitus. N Engl J Med 342: 969-970.

46. Richey JM, Ader M, Moore D, Bergman RN (1999) Angiotensin II induces insulin resistance independent of changes in interstitial insulin. Am J Physiol 277: E920-E926.

47. Ogihara T, Asano T, Ando K, Chiba Y, Sakoda H, et al. (2002) Angiotensin II-induced insulin resistance is associated with enhanced insulin signaling. Hypertension 40: 872-879.

48. Brenner BM, Cooper ME, de Zeeuw D, Keane WF, Mitch WE, et al. (2001) Effects of Losartan on Renal and Cardiovascular Outcomes in Patients with Type 2 Diabetes and Nephropathy. N Engl J Med 345: 861-869.

49. Sowers JR (2004) Insulin resistance and hypertension. Am J Physiol Heart Circ Physiol 286: 1597-1602.