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Original Article

Hypertension in Iranian Urban Population, Epidemiology, Awareness, Treatment and Control

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Abstract

Background: To assess the epidemiological characteristics of hypertensive patients in urban population of Yazd, A central city in Iran.

Methods: This cross sectional study was conducted from 2005-2006 and carried out on population aging 20-74 years. It is a part of the phase I of Yazd healthy heart program that it is a community interventional study for prevention of cardiovascular disease. Data obtained from questionnaires were analyzed by SPSS version 13. *P* value less than 0.05 were considered significant level.

Results: This study comprised of 2000 participants that 847 (42.5%) were diagnosed as being hypertensive. After age adjustment, prevalence of hypertension was 25.6% (23.3% for women and 27.5% for men (P< 0.001). Age, Total cholesterol, LDL-cholesterol, triglyceride, fasting blood glucose, impaired glucose tolerance test, body mass index and waist were significantly higher in the hypertensive groups. 53.7% of hypertensive cases were aware of own condition, 45% were treated, and 33.9% of treated were controlled (30.7% and 35.4% in men and women respectively). In other word, 24% of all hypertensives (aware or unaware about own blood pressure condition) were treated and only 8% of them were controlled. Men significantly had less awareness (P< 0.001), lower tendency to take medication (P< 0.001), and less were controlled (P= 0.046).

Conclusion: We understand high prevalence, low awareness, treatment, and control of hypertension and higher prevalence of other traditional metabolic risk factors in these cases. It seems that urgent preventional studies should be conducted in this population.

Keywords: *Epidemiology, Awareness treatment and control, Hypertension, Urban Population*

Introduction

Hypertension is a significant health problem in most developing countries, which are in the epidemiological transition era from communicable to noncomminicable disease. The increase in rate of hypertension and other vascular diseases could be attributed to the aging of population, obesity prevalence, salt intake, sedentary life, urbanization, and socioeconomic changes (1).

About 90% of normotensive individual over 50 yr of age will suffer from hypertension later in their lives (2). Ranges for hemorrhagic stroke in united state were 18-66% and 15-49% and for ischemic stroke were 8-44% and 12-45% and concluded that up to 66% of some subtypes for CVD (Cardio Vascular Disease) can be attributed to hypertension (3).

Padwal et al observed that hypertension was impli-

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cated in 35% of all atherosclerotic cardiovas-cular events, including 49% of all cases of heart failure (4). As knowledge about the detrimental consequences of hypertension and the beneficial effect of its treatment and control on the prevention of cardiovascular diseases increases, more people visit doctors to measure and control their blood pressure. This had led to substantial improvement in awareness, treatment, and control of hypertension since 1970. Furthermore, it has been effective in reducing cardiovascular events in the recent decade in the USA (5). Despite these substantial improvements, still rate of BP control is less than optimal and even a decrease in this rate has been observed (6).
According to the recent reports, hypertension is one of the main causes of morbidity and mortality in the developing countries such as Iran, since a large number of population are affected by hypertension, burden of even a mild increase in BP is similar to serve diseases (4).
In 1999, Framingham study reported that 34.7% of individuals were normotensive, 13.4% were pre-hypertensive, 12.9% were in the first stage of hypertension, 3.6% were in the second or higher stages, and 26.4% received antihypertensive drugs (7). BP control has desirable impacts on morbidity and mortality. Treatment of patient with hypertension results in 60% reduction of risk of a cardiovascular mortality in 10 yr (5). In fact, reduction in cardiovascular mortality in the recent decades could be attributed to the improvement of treatment (34%), reduction of risk factors such as hypercholesterolemia, and smoking (29%), and primary prevention programs for healthy people (25%). In other words, it is more than 50% due to the reduction and control of risk factors. Prevention programs have not decreased the incidence of hypertension, but delayed its onset, indeed, and during 30 yr of Framingham study, incidence of hypertension was constant (5).
This current study was conducted to assess the epidemiological characteristics of hypertensive patients and awareness, treatment and control status of hypertension in them in Yazd urban population, a central city in Iran.

Materials and Methods

Sampling procedure

This study was carried out in urban populating aging 20-74 yr of Yazd, a central city in Iran. It is a part of the phase I of Yazd healthy heart program that it is a community intervention study for prevention of cardiovascular disease. Individuals were recruited by cluster sampling. One hundred clusters were randomly assigned. From each cluster, 20 families and one person from each family were selected. Participants were classified in 5 aging groups: 20-34, 35-44, 55-64, and 65-74 yr old. One man and one woman from each group were interviewed and examined. Cluster sample size with cluster coefficient of 1.4 was estimated according to previous CVD risk factor prevalence studies.

Data collection

Samples were called via mail, giving general information about the study and the data of interview. Interview and completion of questionnaires were performed by 20 trained health professionals at the house of participants. Only one person in each family was questioned.
First questionnaire included questions covering demographic characteristics, socioeconomic status, knowledge, and perception of samples on cardiovascular disease, risk factors, and methods of control and prevention of them. BP was measured twice at 5 min interval by a mercury sphygmomanometer. KorotKoff first and fifth phase sounds were recorded as systolic and diastolic blood pressure, after that participants referred to health centre to perform biochemical tests and anthropometric measurements. The results along with other information of participants on the relevant performance in lieu of risk factors and prevent and control of hypertension were recorded in the second questionnaire by the same interviewer. In addition, two BP readings were obtained. The average of these four readings was used for analyses. Biochemical-tests were taken after at least 12 h of fasting and comprised of blood sugar (FBS), total cholesterol (TC), triglyceride (TG),

LDL- cholesterol, and HDL- cholesterol. Qualitative control of data collection, lab, sphygmomanometer, weighting scale, and echocardiogram was regularly done and results were recorded. No significant fault or mistake was observed in the instruments or tests based on the lab standards.

Definition of risk factors

Hypertension is considered as a systolic BP over 140 mmHg or diastolic BP over 90 mmHg in two different occasions or is currently taking antihypertensive medication. Hyperlipidemia, Diabetes, Obesity and Abdominal obesity were defined based on national cholesterol education program; adult panel III criteria.

Statistical analyses

Statistical analysis was performed by SPSS Ver. 13. Age and sex adjusted prevalence was reported based on census data in 2006 about age and sex distributions. Odd ratios with confidence interval of 95% were used to examine risk estimate. Binary logistic regression analysis and ENTER model was perform for detection of the most important predictors of hypertension. *P* value less than 0.05 were considered significant level.

Results

This study comprised of 2000 participants that 847 (42.5%) were diagnosed as being hypertensive consisting of 432 men and 415 women. After age adjustment using the community age distribution, prevalence of hypertension was 25.6% in age group of 20-74 yr in urban population of Yazd (23.3% for women and 27.5% for men). We did not see any correlations between clusters and hypertension, age, sex and other CVD risk factors. As a result survey data analysis was not performed.

Age and results of biochemical tests and anthropometric measurements in hypertensive and normotensive groups are shown in Table 1. Age, TC, LDL-c, TG, FBS, GTT, BMI, and waist were significantly higher in the hypertensive groups.

Samples unaware of being hypertensive were 46.2%. This rate in men was 54.5% and in women was 30.6% ($P< 0.001$). Furthermore, 11.9% of individuals had never measured their BP, 5.7% of hypertensives and 16.4% of normotensives.

The mean age of these participants was 40 years that was significantly lower than those that had at least one previous BP measurement. Table 2 illustrates proportion of hypertensive individuals that were aware, treated, and controlled, classified by gender and age. As it is shown, 53.7% of hypertensives were aware of condition, 45% were treated, and 33.9% of treated were controlled, 30.7% and 35.4% in men and women respectively. In other word, 24% of all hypertensives (aware or unaware about own blood pressure) were treated and only 8% of them were controlled.

About 32.5% of aware samples regularly measured their BP, (men 33.8% and women 38.3%, $P= 0.2$. Out of 356 hypertensive men, 143(40%), and out of 366 hypertensive women, 239(65%) were taking drugs ($P= 0.046$).

As it is demonstrated in Table 3, only 29% of samples were normotensive, 51.3% were prehypertensive, 9.3% were in the first stage of hypertension, 2.1% were in the second stage or higher, and finally 8.3% were using antihypertensive drugs.

Prevalence of risk factors among hypertensive is shown in Table 4. As it is illustrated, diabetes, obesity, abdominal obesity, lipid disorders, GTT were significantly higher in the hypertensive group ($P< 0.001$).

In addition, prevalence of hypertension was assessed against demographic characteristics, clinical, and socioeconomic variables.

As it can be observed in Table 5, rates of hypertension is significantly higher in the following groups: older participants (with each to year increase in age, rate increases by 1.5 times), obese (2 times), diabetics (1.5 times), hypercholestrolemic (1.3 times), and individuals with abdominal obesity (1.5 times).

Table 1: Demographic and laboratory data in hypertensives and normotensives

Clinical and Para clinical data	Hypertensives (Mean) (SE)			Normotensives (Mean) (SE)			
	Male	Female	Total	Male	Female	Total	*P* Value
Age	56(0.6)	57(0.6)	56(0.6)	43 (0.6)	42(0.5)	42(0.4)	0.001
BMI	26.1(0.17)	28.3(0.23)	27.2(0.15)	24.1 (0.15)	26.4(0.18)	25.2(0.12)	0.001
Waist	0.94(0.02)	0.94(0.02)	0.94(0.02)	0.89 (0.03)	0.87(0.04)	0.88(0.03)	0.001
TC	198(2)	218(2.1)	208(1.5)	185(1.7)	195(1.8)	190(1.3)	0.001
HDL-c	50(0.6)	55(0.6)	53.1(0.6)	52 (0.5)	56(0.5)	54.5(0.4)	0.09
LDL-c	108(1.7)	121(1.8)	115(1.2)	100(1.4)	107(1.4)	103(1.06)	0.001
TG	200(5.8)	201(5.3)	200(3.9)	162(4.3)	151(3.8)	156(2.8)	0.001
Uric acid	5.1(0.06)	4.2(0.05)	4.6(0.04)	4.7(0.04)	3.9(0.2)	4.3(0.12)	0.02
FBS	109(2.2)	114(2.6)	111(1.7)	95 (1.4)	97(1.8)	96.2(1.1)	0.001
GTT	*215(17)*	*394(19)*	*354(13)*	*191(11.2)*	*209(11.6)*	*200(8.1)*	*0.001*

Age, Total Cholesterol, LDL-cholesterol, Triglyceride, FBS (fasting blood sugar), IGTT(Impaired glucose tolerance test), BMI(body mass index) and waist were significantly higher in the hypertensive groups.($p<0.05$)

Table 2: Awareness, treatment and control of hypertension according to sex and age groups

Hypertensive	Male (%) Age group (yr) 20-44	Male (%) Age group (yr) 45-74	Male (%) Total	Female (%) Age group (yr) 20-44	Female (%) Age group (yr) 45-74	Female (%) Total	P -value†
Awareness of hypertension	20.7	46.7	41.1	3.3	0.3	6.3	.001
Awareness and treatment of hypertension	12.5	38	33.4	28.3	61	56	0.001
Awareness, treatment and controlled hypertension	4.5	11	10	5	22	20	0.001
BP Control percent in treated hypertensive	36.4	30.1	30.7	17.6	37	5.5	0.18

†: p value of difference between male and female.

As it is illustrated, half of participants were aware of being hypertensive. Men had less awareness, lower tendency to take medication and less were controlled.

Table 3: Hypertension severity according to JNC7 classification

Hypertension severity	n	%
Normal	383	19.3
Pre hypertension	890	44.6
Stage I	269	13.5
Stage II	71	3.5
Anti hypertensive drug User	380	19.1
Total	1993	100

Only 19.3% of samples were normotensive, 44.6% were prehypertensive, 13.5% were in the first stage of hypertension, 3.5% were in the second stage, or higher, and finally 19.1% were using antihypertensive drugs.

Table 4: CVD risk factors in hypertensives and normotensives

CVD risk factors	Smoking n (%)	Lipid disorder ** n (%)	Abdominal obesity* n (%)	BMI > 30 n (%)	IFG n (%)	IGTT n (%)	DM n (%)
Hypertensive	102(12.1)	695 (82.7)	382 (45.6)	216 (25.7)	23 (3)	119 (15.7)	241 (31.9)
Normotensive	169 (14.7)	693 (60.4)	282 (24.7)	160 (14)	20 (1.9)	101 (9.3)	142 (13.1)
P value	0.054	0.001	0.001	0.001	0.09	0.001	0.001

*Abdominal obesity: Waist/Hip ratio> 1 in men, Waist/Hip ratio> 0.8 in women
**Lipid disorder:: (positive lipid lowering drug history: (LDL > 130) or (HDL < 35) or (Triglyceride>150) or (Cholesterol > 200) or

Diabetes, obesity, abdominal obesity, lipid disorders, Impaired glucose tolerance test (IGTT) were significantly higher in the hypertensive group ($P< 0.05$).

Table 5: Clinical and paraclinical variables in hypertensives according to multivariate logistic regression

Variables	n (%)	*P*	Multivariate logistic regression		
			OR†	95CI%	*P*
Sex					
Female	419 (23.3)	0.30	0.95	(1.13-0.79)	0.3
Male	428 (27.5)				
Age					
20-34	40 (10)	0.0001	-	-	-
34-44	108 (27)		3.1	(4.6-2.06)	0.00
45-54	163 (40.2)		5.1	(3.4-7.7)	0.00
55-64	257 (64.6)		12.7	(8.4-19.2)	0.00
65-74	279 (70.1)		16.2	(10.7-24.7)	0.00
Body Mass Index (BMI)					
< 25	251(31)	0.0001	-	-	-
25-30	372 (47)		3	(2.3-3.8)	0.000
> 30	216 (58)		1.5	(1.2-195)	0.001
Smoking					
Smoke ≥ 10/Day	102 (37.6)	0.054	0.66	(0.48-0.91)	0.011
Never smoker	739 (43)				
Total Cholesterol (mg/dl)					
< 200	373 (34)	0.001	-	-	-
200-240	283 (48.8)		1.2	(1.01-1.5)	0.02
> 240	183 (55)		1.3	(1.03-1.8)	0.03
Fasting blood (mg/dl) sugar					
<110	584 (37.2)	0.0001	-	-	-
110-126	78 (62)		1.2	(0.79-1.7)	0.07
126<	175 (60)		1.5	(1.04-2.3)	0.02
Waist/ hip ratio					
Normal	445 (34.6)	0.0001	1.5	(1.3-2.2)	0.00
Abnormal	385 (57.7)				

†:OR in each age groups according to later

As it can be observed, rates of hypertension is significantly higher in the following groups: older participants (with each to year increase in age, rate increases by 1.5 times), obese (2 times), diabetics (1.5 times), hypercholestrolemic (1.3 times), and individuals with abdominal obesity (1.5 times)

Discussion

This study focused mainly on hypertension prevalence, awareness, treatment, and control of this disease. Prevalence of hypertension was 25.6% in age group of 20-74 yr in urban population of Yazd, a central city in Iran. This prevalence for women was 23.3% and for men was 27.5%, but a systematic review in Iran showed that the prevalence of hypertension in men was 1.3% less than that in women (8).
The prevalence of hypertension in United States is 31.3%. The number of adults with hypertension increased by 30% (65 million) for 1999-2000 compared with at least 50 million for 1988-1994 (6). These trends were associated with increased obesity, aging, and growing population. According to sex differences in prevalence of hypertension some studies consider that sex modify the effect of gene variants on disease. Investigation of gene by sex interaction may help to elucidate underlying genetic susceptibilities and explain the sexual dismorphism of this complex trait.
The insulin resistance and sex hormones describes the gene-sex interaction in relationship of coronary artery diseases and its risk factors (9).
Animal studies refute in hypothesis that CVD risk factor is mediated by androgen in males. For example, male rats have higher blood pressure than female rats. Removal of testes in male rats reduces blood pressure. Similar observations have been made in model of non-genetic hypertension, such as DOCA-salt treated rates. The mechanisms by which androgens could initiate and/or mediate hypertension have not been elucidated.
One of the most important recent findings showed that testosterone is able to stimulate directly sodium reabsorption via proximal tubule of the kidney. Investigators had shown previously that androgen were localized to the proximal tubule of the kidney and because androgens could affect the synthesis of components of RAS in had been hypothesis that androgen could mediated sodium reabsorption indirectly via the RAS. This new information is particularly important because it provides evidence that androgens can affect proximal sodium reabsorption (10).
Directly one thereby influence blood pressure by a variety of mechanism as mentioned, one mechanism by which androgens could cause CVD and hypertension is via its effects on product of vasoconstrictors. Plasma rennin activity is typically higher in men than in premenopausal women and androgens could cause an increase angiotensin II product in the kidney. Androgen has also been shown to cause an increase in endothelia in humans. In addition, we observed that hypertension prevalence increase with age rises; 10% in 20-34 tears old VS. 70% in who had 65-74 yr old (*P*= 0.001) (10).
Stanely et al by using Framingham heart study data via longitudinal design from 1953-57 included normotensive participants and estimate hazard ratio for developing isolated systolic and systolic diastolic hypertension, he conformed that older age, female sex and increased BMI are predictors of systolic hypertension incidence (11).
High prevalence of hypertension in Tehran city was shown by Larijani et al in 2004 that was 41.7% in men and 37.6% in women (12). This data was 21% in Isfahan (13), 22.9% in Tehran No.3 area (12) and in Bushehr 17.2% (14). Overall prevalence of hypertension 30–55 and >55 yr old population were around 23% and 50%, respectively (15). Also sex difference in hypertension prevalence was seen in these study that up to 34 yr old hypertension was prominent in men, then was equal between men and women up to 54 yr old than then was prominent in women (12), that this finding confirmed by our data that hypertension up to 44 yr old was more prevalent in men, equal in men and women up to 54 and then in women more prevalent.
According to severity and awareness of hypertension in our study among total samples 51.3% of them belong to pre hypertension stage, 9.3% to stage I hypertension , 2.1% to stage II and 29% had normal systolic and diastolic blood pressure and 8.3% had anti hypertension drugs.

Also in our study awareness, treatment and control was 53.8, 44.9% and 33.9% respectively, Awareness, treatment and control of hypertension of Indian population in 1998 were 50%, 34% and 10% respectively (16) and in Portugal in 2005 was 64%, 39% and 11.2% (17), in China in 2003 was 44.7%, 28.2% and 8.1% (18) and in Korea in 2001 was 78.6%, 24.6% and 24.3% (19). Martin et al studied on western pacific and south-east Asian regions and showed that in 15 countries with available data, the prevalence of hypertension ranged from 5-47% in men and from 7-38% in women (3).

Awareness, treatment, and control of hypertension among United States adult in the period 1999-2004 overall prevalence was 29.3%. The blood pressure control rate was 29.2$\pm$2.3% in 1999-2000 and 36.8%$\pm$2.3% in 2003-2004. The age-adjusted increase in control rate 8.1% (95% CI: 2.4 to 13.8, *P*= 0.006). Control rate significantly different in both sex (20).

Among the ≥60 age group, the awareness, treatment and control rates of hypertension had all increased significantly. Although in the overall prevalence, awareness and treatment rates of hypertension were no significant increases (21).

Also national high blood pressure program (NHBPP) showed that awareness, treatment and control of hypertension was changed from 51% to 68.4% awareness, 31% to 53.6% treatment and 10% to 27.4% control of blood pressure from 1974-76 to 1976-1994 in united state (11). On the other hand, awareness of target blood pressure among patients was very poor.

Only 66.1% of patients could recall their own systolic and diastolic blood pressure levels and only 48.9% of all patients could correctly name targets for these values (15).

In conclusion, we understand high prevalence, low awareness, treatment, and control of hypertension in Yazd urban population. As it can be observed, hypertension is significantly higher in the following groups respectively: older participants, obese, diabetics, hypercholesterolemia, and individuals with abdominal obesity. It seems that urgent preventional studies should be conducted in this population.

Ethical Considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

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