

Predictors of hypertension control in Turkey: the MELEN study

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Abstract. – BACKGROUND: Hypertension is one of the most common causes of atherosclerosis, morbidity and mortality in adults. A total of 11 million hypertensive patients were estimated in Turkey.

AIM: The aim of this study was to investigate the prevalence, awareness and control of hypertension in Duzce and compare the current data with the literature.

PATIENTS AND METHODS: The visits were carried out in May and June, 2010 in Yigilca town health centre on 2298 participants (1471 female, 827 male with a mean age of 50). Data were obtained by a simple form, physical examination and sampling of blood. Hypertension was defined as a blood pressure 140 mmHg and/or 90 mmHg, and/or use of antihypertensive medication. The data of patients under control were compared with the patients who were not under control.

RESULTS: Hypertension was detected in 964 participants. General prevalence was 42%. Hypertension awareness ratio was 70%, use of antihypertensive medication was 39% and the ratio of patients under control was 28%. Antihypertensive drug use, age and awareness were lower in the uncontrolled group. Logistic regression analysis revealed that only antihypertensive drug use and BMI < 30 were the independent predictors of hypertension under control [Odd's ratio (OR) = 3.43; 95% confidence interval (CI) = 2.54-4.64, $p < 0.001$ and OR = 1.69; 95% CI = 1.23- 2.32, $p = 0.01$; respectively].

CONCLUSIONS: Hypertension is one of the most important public health problems in Turkey. According to the literature data the awareness of hypertension was increased significantly in the last five years. On the other hand, control ratio was increased very little compared with the previous studies.

Key Words:

Hypertension; Prevalence, Control, Treatment, Awareness.

Introduction

Hypertension is one of the most common causes of atherosclerosis, morbidity and mortality in adults¹. TEKHARF study^{2,3} showed that the prevalence of hypertension was 33.7% in 2003 in Turkish adults. A total of 11 million hypertensive patients were estimated. The prevalence was 31.8%, 41.7% and 32.7% in other three nationwide epidemiologic surveys (PATENT, METSAR, CREDIT, respectively)⁴⁻⁶. The proportion of awareness of hypertension among patients with hypertension was 40.7% in the PATENT study⁴. The same study also revealed that the control ratio was 20.7%. According to the METSAR data the rate was only 6%. According to TURKSAHA, the largest study to date about the control of blood pressure in Turkey, the control ratio was 24.2%⁷. When the gender differentiation is not taken into account, hypertension is the most common cardiovascular risk factor after obesity, and is still a significant public threat due to lack of awareness and insufficient control.

The aim of the present investigation was to evaluate the most current prevalence of hypertension, awareness, control ratio and compliance to the antihypertensive treatment.

Patients and Methods

Study Cohort

The MELEN Study is a prospectively designed survey on the prevalence of cardio metabolic risk factors in Turkish adults. The baseline visits were carried out in May and June, 2010 and biennial follow-up visits were planned. The name of the study comes from the geographic

valley in north-east of Duzce, Turkey which is inhabitant of 21000 people. There is a town centre (Yigilca) and 37 villages. Health Service of the region was supplied by six family physicians, each following up almost 2500 adults. The study was conducted in May and June, 2010 in the Social Health Center located in the town center. 400 adult subjects (> 17 years old) from each family physician representatively stratified for sex, age and for rural-urban distribution were randomly assigned and invited to participate the study. A total of 2298 subjects with a mean age of 50 (age range 18 to 92) were interviewed. The study protocol was approved by the Ethics Committee of Duzce University and every subject signed a consent form. Data were obtained by a simple form for answers, physical examination and measurements of carotid-intima media thickness, body fat composition, ECG, echocardiography and sampling of blood.

Sample Collection

Ten milliliters of blood were drawn from the antecubital vein of each subject by applying minimal tourniquet force. Eight ml of blood was drawn into a vacutainer tube without anticoagulant. These blood samples were allowed to clot for 20 min prior to centrifugation. The blood tubes were centrifuged for 10 min at $1500 \times g$ and were processed within 30 minutes in place. Sera were shipped within a few hours on cooled gel packs at $2-5^{\circ}\text{C}$, to the Duzce University Central Laboratory where they were kept at -80°C until the final analyses.

Biochemical Analysis

Plasma concentrations of cholesterol, fasting triglycerides, HDL-cholesterol, glucose, electrolytes, liver function tests and other biochemical variables were measured by a Cobas 6000 auto analyzer using commercially available kits (Roche Diagnostics GmbH, Mannheim, Germany). LDL-cholesterol values were computed according to the Friedewald formula.

Measurements and Definitions

Measurement of the blood pressure was performed with a sphygmomanometer (Erka, Erlangen, Germany) after 10 min rest in seated position, and the left arm was used. The mean of the three measurements of each patient was recorded. The height, weight, and body mass index (BMI) were also recorded. An echocardiography machine utilizing 2-5 MHz probe specific for

field studies (M Turbo, SonoSite Inc., Bothell, WA, USA) was used to measure the left ventricular mass index (LVMI) with Devereux's method as recommended by The American Society of Echocardiography⁸.

The individuals with arterial blood pressures higher than 140/90 mmHg, under antihypertensive drug therapy, or with hypertension history together with no use of antihypertensive drug were accepted as hypertensive. Based on JNC VII criteria, measurements of < 140/90 mmHg in uncomplicated patients, < 130/80 mmHg in diabetics, and < 125/75 mmHg in chronic renal insufficient patients were accepted as under control. BMI > 30 individuals were accepted as obese, according to WHO recommendations. Patients under drug therapy or whose fasting plasma glucose levels were ≥ 126 mg/dL or postprandial glucose ≥ 200 mg/dL were accepted as having diabetes⁹. A thyroid stimulating hormone (TSH) level of < $0.35 \mu\text{IU/mL}$ was accepted as hyperthyroidism and > $4.5 \mu\text{IU/mL}$ as hypothyroidism.

Statistical Analysis

Statistical Package for Social Sciences software 12 (SPSS Inc., Chicago, IL, USA) was used for analysis. Descriptive parameters were shown as mean \pm standard deviation or in percentages. Two-sided *t*-tests and Pearson's chi-square tests were used to analyze the differences in means and proportions between groups. Abnormally distributed variables were compared using the Mann-Whitney U test. A logistic regression analysis was performed to evaluate the independent predictors of control of hypertension. The covariates included in the analysis were age, smoking, gender, anti-hypertensive drug use, regular physical activity, diabetes mellitus and body mass index. A *p* value below 0.05 was considered significant.

Results

Hypertension was detected in 964 of the participants, and the general prevalence was 42%. The rate was 43% in woman, and 39% in men. Number of participants with a history of hypertension was 668. Two-hundred sixty nine participants who did not have any history of hypertension had high arterial blood pressure (30%). Among the patients with hypertension history only 374 were under antihypertensive drug thera-

py (56% of the subjects who were aware of their high blood pressure and 39% of the total hypertension cohort). Blood pressure measurements were below the target level in 273 patients (the success rate was 73% in patients under drug therapy and 28% in the whole cohort). One hundred forty five of the 374 patients under drug therapy did not know which drug he/she was using (39%). The most common drug type was diuretics (99 patients), which was followed by angiotensin receptor blockers (94), angiotensin converting enzyme inhibitors (91), beta blockers (73), calcium channel blockers (65), and alpha blockers (7). Multidrug use was detected in 127 subjects (34%).

When the patients under control were compared with the rest of the patients, the rate of awareness of hypertension, drug use due to comorbid factors involving long-term medication, and mean age were higher in patients under control (Table I). Logistic regression analysis showed that only antihypertensive drug use and BMI < 30 were the independent predictors of hypertension under control [Odd's ratio (OR)= 3.43; 95% confidence interval (CI) = 2.54-4.64, $p < 0.001$ and OR = 1.69; 95% CI = 1.23-2.32, $p = 0.01$; respectively] (Table II).

Discussion

The overall hypertension rate was 42% in this study which was the highest prevalence among all other epidemiologic surveys³⁻⁶. This result is in concordance with TEKHARF follow-up data of the last 18 years¹⁰. According to the most recent TEKHARF data mean systolic blood pressure was increased 4.4 mmHg in men and 6.4 mmHg in woman during the last 18 years. The highest rate in hypertension was reported in the Black sea region of Turkey in the CREDIT study in which 10443 individuals were scanned in 2010 in Turkey⁶. In the light of these data, it is suggested that the hypertension rate is continuously increasing in Turkey with a declining speed.

According to the current results hypertension rate is higher in woman than in men, and increases with age which was in concordance with the previous surveys. According to the TEKHARF study, the rates were higher in woman (46% vs 38%), much similar to the present results (43% vs 39%).

The rate of awareness of hypertension was 70% in the present study, the highest ever detected. The value was a gladsome improvement since the district had the lowest sociocultural lev-

Table I. Comparison of patients under control with the rest (% in parenthesis).

	Target BP reached (n=273)	Target BP unreached (n=691)	p value
Age	59 ± 11	57 ± 12	0.01
Gender: female n	181 (66)	455 (66)	0.995
History of hypertension: n	273 (100)	395 (58)	< 0.001
Hypertension duration: years	5.7 ± 5.2	4.9 ± 5.4	0.055
Regular drug users: n	162 (59)	212 (31)	< 0.001
Smokers: n	27 (10)	77 (11)	0.572
Regular alcohol users: n	9 (5)	33 (3)	0.31
Diabetes: n	134 (49)	352 (51)	0.603
Hyperthyroidism: n	42 (17)	109 (17)	0.949
Hypothyroidism: n	18 (7)	46 (7)	0.986
Monthly Income: (Turkish Lira)	733 ± 584	764 ± 588	0.463
Regular physical activity	11 (4)	13 (2)	0.054
Body mass index: kg/m ²	31 ± 7	32 ± 7	0.126
Fasting plasma glucose: mg/dL	124 ± 62	128 ± 61	0.357
HDL: mg/dL	44 ± 13	44 ± 11	0.777
LDL: mg/dL	106 ± 33	110 ± 34	0.203
Total cholesterol: mg/dL	186 ± 40	190 ± 39	0.158
Triglyceride: mg/dL	185 ± 111	194 ± 120	0.271
Creatinine: mg/dL	0.84 ± 0.24	0.82 ± 0.27	0.473
Uric acid: mg/dL	4.4 ± 1.2	4.3 ± 1.2	0.115
Hemoglobin: g/dL	13 ± 1.3	13.2 ± 1.6	0.463
Left ventricular mass (g/m ²)	233 ± 68	236 ± 67	0.481

BP: blood pressure.

Table II. Independent predictors of hypertension control with logistic regression analysis.

	Odds ratio	95% confidence Interval	p value
Age	1.01	0.99-1.02	0.268
Gender	0.99	0.71-1.38	0.957
Antihypertensive drug use	3.43	2.54-4.64	< 0.001
Regular physical activity	1.88	0.78-4.52	0.156
Diabetes	0.9	0.67-1.21	0.487
Smoking	0.87	0.53-1.45	0.603
Body mass index < 30	1.69	1.23- 2.32	0.01

el in the province, and that the rate was lower according to the reports of the PATENT study published in 2005⁴. Recently, a campaign of awareness of hypertension had been derived in the leadership of The Turkish Society of Cardiology and it was intended by means of media ads to gain a nationwide improvement in the control of hypertension. This campaign titled “12/8 my blood pressure is under control” was supposed to play a pivotal role in this progress.

The rate of antihypertensive drug therapy was 39% in the present work, a satisfactory value since it was reported as 31.1% five years ago⁴. Although the progress is considerable, the above mentioned dramatic improvement in awareness did not reflect to the treatment level.

In evaluating the drugs prescribed to the patients, the first rate group was Renin Angiotensin System (RAS) blockers (49%), ACE and Angiotensin Receptor Blockers (ARB) together evaluated). One of the two patients was given RAS blockers, which in turn suggests the preference of metabolic neutral agent use rather than old fashioned beta blocker based regimens. Formerly, two studies focusing on the clinicians’ trends of antihypertensive therapy yielded similar results^{7,11}.

One of the uppermost results of the present study was the increase in rates of treatment control. Considering that the efforts in the diagnosis would be insignificant unless the results are not reflected to the treatment or control rates. The control rate in the present cohort was 7% higher than the PATENT data (20.7% vs 28%), 22% than the METSAR, 4% than the TURKSAHA and 2% than the TEKHARF studies, despite the increasing overall prevalence^{4,5,7,10}. Since the year 2003, radical modifications are implemented in Turkey within the scope of the “Transformation in Health Service” project conducted by the Ministry of Health. The utmost importance in the Project is to convert the cottage hospital based delivery of pri-

mary health care, and shift it up to role modeling of family medicine. The implementation based on law numbered 5258 and was started by 12/9/2004 in some pilot cities, Duzce being the first. Therefore, the increase in the control rate might be due to the family medicine practice.

Exploring the study in terms of reaching the target levels, factors of antihypertensive drug use and BMI < 30 manifested to be the independent predictors. This outcome can be matched to the TURKSAHA study with the exception of age and diabetes existence⁷. However, in Turksaha survey antihypertensive drug use was not included in the analysis. Knowing the fact that gender, age and regular physical activity affects the hypertension control, these parameters were witnessed to deceive their independences since the present cohort possesses antihypertensive drug use as a powerful covariant. Taking in hand that the rate of drug use remained as low as 39%, it is obvious that future campaigns should need to focus particularly on this area despite the strive and increase in the rate of awareness. Gross epidemiologic studies have also proved that obesity is one of the foremost parameters that impede the control rate¹². The activation of RAS and subsequent sodium retention by the fat tissue messes up the blood pressure control¹³. It can be inferred from the cohort that Turkish people did not still get accustomed to regular physical activity and exercise (The rate of regular exercise was below 3%). Taking into account the influence on obesity and hypertension control, life style change and acquiring custom of exercise in adults have vital importance.

Conclusions

Hypertension keeps on existing as one of the most considerable health problems in Turkey. This study comprehends a relatively small co-

hort of subjects of one specific area of the country. It is evident that implementation of family medicine should be employed more effectively to overcome the problem of hypertension in Turkey in spite of the limited improvement in the control rates. We are in need for novel strategies and nationwide plans of action in the treatment process, in which altering the life style is not neglected, the family practitioners are trained vigorously for the solution of the problem and the importance of antihypertensive use is emphasized.

Conflict of Interest

None declared.

References

- 1) HE J, WHELTON PK. Epidemiology and prevention of hypertension. *Med Clin North Am* 1997; 81: 1077-1097.
- 2) ONAT A, ENOCAK M, ÖRNEK E, GÖZÜKARA Y, URDUM-AVCI G, KARAASLAN Y, OZIK U, ISLER M, TASKIN V, TABAK F, OZ O, OZCAN O. Türkiye'de erişkinlerde kalp hastalığı ve risk faktörleri sikliği taraması: Hipertansiyon ve sigara içimi. *Arch Turkish J Card* 1991; 19: 169-177.
- 3) ONAT A, TÜRKMEN S, KARABULUT A, YAZICI M, CAN G, SANSOY V. Türk yetişkinlerinde hiperkolesterolemi ve hipertansiyon birlikteliği: Sikliğine ve kardiyovasküler riski öngördürmesine ilişkin TEKHARF çalışması verileri. *Arch Turkish J Card* 2004; 32: 397-405.
- 4) ALTUN B, ARICI M, NERGIZO LU G, DERICI U, KARATAN O, TURGAN C, SINDEL S, ERBAY B, HASANO LU E, CALAR S; FOR THE TURKISH SOCIETY OF HYPERTENSION AND RENAL DISEASES. Prevalence, awareness, treatment and control of hypertension in Turkey (the Paten T study) in 2003. *J Hypertens* 2005; 23: 1817-1823.
- 5) OGUZ A. FOR THE METSAR INVESTIGATORS. Metabolic syndrome prevalence in Turkish adults. XX. National Cardiology Congress, Cardiology Congress Abstract Book, Antalya, Turkey 2004; p. 15.
- 6) SÜLEYMANLAR G, UTAS C, ARINSOY T, ATEŞ K, ALTUN B, ALTIPARMAK MR, ECİDER T, YILMAZ ME, ÇAMSARI T, BAÇI A, ODABAS AR, SERDENGEÇİ K. A population-based survey of Chronic Renal Disease In Turkey; the CREDIT study. *Nephrol Dial Transplant* 2011; 26: 1862-1871.
- 7) ABACI A, OUZ A, KOZAN Ö, TOPRAK N, SENOCAK H, DEGER N, SAHİN M, SUR H, FİCİ F, EROL C. Treatment and control of hypertension in Turkish population: a survey on high blood pressure in primary care (Turksaha study). *J Hum Hypertens* 2006; 20: 355-361.
- 8) DEVEREUX RB. Method of recognition and assesment of left ventricular hypertrophy. *Medicographia* 1995; 17: 12.
- 9) GENUTH S, ALBERTI KG, BENNETT P, BUSE J, DEFONZO R, KAHN R, KITZMILLER J, KNOWLER WC, LEBOVITZ H, LERNMARK A, NATHAN D, PALMER J, RIZZA R, SAUDEK C, SHAW J, STEFFES M, STERN M, TUOMILEHTO J, ZIMMET P; EXPERT COMMITTEE ON THE DIAGNOSIS AND CLASSIFICATION OF DIABETES MELLITUS. Follow-up report on the diagnosis of diabetes mellitus. *Diabetes Care* 2003; 26: 3160-3167.
- 10) ONAT A (EDITOR). *Tekharf* 2011. 1st edn. Logos Inc: Istanbul 2011. pp. 79-91.
- 11) ÖZKARA A, TURGUT F, SELÇUK Y, KANBAY M, KARAKURT F, TEKİN O. Hipertansiyon hastalarının ilaçlarına ve sağlık merkezlerine uyumları. *Yeni Tıp Dergisi* 2008; 25: 97-101.
- 12) REDÓN J, CEA-CALVO L, MORENO B, MONEREO S, GIL-GUILLÉN V, LOZANO JV, MARTÍ-CANALES JC, LLISTERRI JL, AZNAR J, FERNÁNDEZ-PÉREZ C; INVESTIGATORS OF THE PREV-IC-TUS STUDY. Independent impact of obesity and fat distribution in hypertension prevalence and control in the elderly. *J Hypertens* 2008; 26: 1757-1764.
- 13) ENGELI S, NEGREL R, SHARMA AM. Physiology and pathophysiology of the adipose tissue renin-angiotensin system. *Hypertension* 2000; 35: 1270-1277.