# PREVALENCE AND SEVERITY OF CORONARY ARTERY DISEASE AMONG HYPERTENSIVE AND NORMOTENSIVE PATIENTS

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## Abstract

**BACKGROUND:** Treatment of hypertension (HTN) as an important risk factor of coronary artery disease (CAD) is for prevention of its mortality. The aim of the present study was to investigate risk factor distribution, prevalence and severity of CAD among hypertensive and normotensive patients undergoing elective coronary angiography in Tabriz Madani Heart Center.

**METHODS:** In a descriptive cross-sectional study, 976 out of 3000 patients who underwent coronary angiography (CAG) between February 1, 2005 and February 1, 2006 were randomly selected to enter the study. Demographic and angiographic data were collected. Data entry and analysis was done by SPSS software version 11.5 and EPI software version 6.4.

**RESULTS:** Prevalence of hypertension in patients who underwent coronary angiography was 60.5%. Prevalence of CAD was 84% and 87% in hypertensive and normotensive patients, respectively (P = 0.2). Prevalence of diabetes mellitus and hyperlipidemia were more frequent in hypertensive patients (P = 0.001). Although the prevalence of 3-vessel disease was higher in hypertensive patients (32% vs. 28%) the difference was not significant statistically. The difference in prevalence of CAD among hypertensive and normotensive men was not statistically significant (91% and 92%, respectively); but this difference among women was statistically meaningful (78% vs. 63%, p = 0.01). 3-vessel disease in hypertensive women was more frequent than normotensive women (37% vs. 18%, P = 0.02).

**CONCLUSION:** With regard to high prevalence of cardiac risk factors and severe CAD in hypertensive patients, prompt health measures are needed for control of hypertension in general population especially in the hypertensive women.

**Keywords:** Hypertension, Coronary Artery Disease, Risk Factors.

## Introduction

It is well established that high blood pressure is associated with premature cardiovascular morbidity and mortality.[1] Among the numerous risk factors associated with coronary artery disease (CAD), hypertension plays a major role given its high frequency and its physiopathogenesis.[2] The prevalence of hypertension in the community is determined principally by age and ethnicity.[1] In Pepine study the risk of all complications of CAD was shown to be doubled in the presence of hypertension. Moreover hypertension is a major risk factor of undiagnosed symptomatic or asymptomatic myocardial infarction. The risk of sudden death, heart failure and all cause mortality is increased in hypertensive patients.[3] Numerous other risk factors for CHD, such as dyslipidemia, insulin resistance, diabetes, obesity, lack of physical activity and certain genetic mutations are observed in hypertensive patients more than normotensive ones and various risk factors of CAD are present simultaneously in hypertensive patients.[2,4] The prevalence of hypertension in general population in our country is more than 12%.[5] The

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prevalence and severity of CAD in hypertensive patients has not been studied in our region and considering racial differences, it is not known if the influence of risk factors in the development of CAD is similar to western countries or resembles countries like Japan where the prevalence of CAD is low.[4] The relationship between hypertension and CAD is of complex nature. Cardiovascular structural changes independent of CAD may occur; on the other hand cumulative effect of coronary risk factors like as sympathetic stimulation, insulin resistance and others is not delineated clearly when hypertension is present.[6] False positive exercise test is common among hypertensive patients, especially in women.[7] Myocardial perfusion defects in hypertensive patients without coronary obstruction may occur which might influence the accuracy of diagnostic tests.[8] The aim of this study was to investigate the prevalence of coronary risk factors and patterns of CAD in hypertensive and normotensive patients who were candidate for elective coronary angiography.

## Materials and Methods

In a cross-sectional descriptive study 1000 of 3000 patients who underwent coronary angiography in Shahid Madani heart center between February 1, 2005 and February 1, 2006 were selected randomly to enter the study. Patients with acute coronary syndromes or concomitant valvular diseases were excluded. Demographic data including age, gender, history of hypertension, diabetes mellitus, hyperlipidemia, smoking, family history of CAD and drug history were collected. Hypertension was defined as:

1. Patients with history of hypertension under treatment
2. Patients without history of hypertension but with BP on admission day before coronary angiography more than 139/89 recorded at least twice

Other cardiovascular risk factors included:

- Diabetes mellitus: if the patient had history of DM and was under treatment
- Hyperlipidemia: if the patient had history of

hyperlipidemia and was under treatment
- Family history of CAD: CAD in first degree relatives presenting before the age of 45 in men and 55 in women
- History of cigarette smoking

Coronary artery disease on angiography was defined as obstruction of more than 75% of cross-section or 50% of diameter of the vessel and categorized to 1-, 2- and 3-vessel disease based on the coronary angiography results reported by cardiologists. Relevant data were collected from medical records in questionnaires and the accuracy of data collection was randomly assured weekly by rechecking the data in 5 random patients by the researcher.

### Statistical analysis

Continuous data are expressed as median and categorical data as percentage. A p-value less than 0.05 was considered statistically significant. Comparison of parameters was performed using t-test for continuous variables and the chi squared test for categorical variables. SPSS software version 11.5 and EPI software version 6.4 was used for all analyses.

The research was undertaken under the medical ethics standards.

## Results

Three thousand patients underwent coronary angiography in Tabriz Madani Heart Center between February 1, 2005 and February 1, 2006 for suspected CAD. One thousand patients were randomly selected (84 patients out of approximately 250 patients undergoing coronary angiography each month) and relevant data were collected. Twenty four profiles with incomplete data were excluded. From 976 patients, 594 were hypertensive (60.5%) including 334 (56.2%) male and 260 (43.8%) female. Table 1 summarizes the demographic characteristics of patients. Prevalence of diabetes mellitus was higher in hypertensive patients than normotensive ones (26.6% and 16.2% respectively; P = 0.0001). Hyperlipidemia was more prevalent in hypertensive patients than

**Table 1.** Demographic data of patients

| Characteristics | Hypertensive no (%) | | | Normotensive no (%) | | | P Value |
|---|---|---|---|---|---|---|---|
| | **Men** | **Women** | **Total** | **Men** | **Women** | **Total** | |
| Gender (%) | 334 (56.2) | 260 (43.8) | 594 (60.9) | 314 (82.2) | 68 (17.8) | 382 (39.1) | 0.001 |
| Mean Age (years) | 58 | 60 | 59 | 54 | 55 | 54 | 0.001 |
| Diabetes (%) | 64 (10.7) | 94 (15.8) | 158 (26.6) | 46 (12) | 16 (4.1) | 62 (16.2) | 0.001 |
| Hyperlipidemia | 139 (23.4) | 124 (20.8) | 263 (44.3) | 99 (25.9) | 23 (6) | 122 (32) | 0.001 |
| Smoking (%) | 148 (24.9) | 19 (3.1) | 167 (28.1) | 198 (51.8) | 9 (2.3) | 207 (45.2) | 0.0001 |
| Family Hx. (%) | 15 (2.5) | 23 (3.8) | 38 (6.4) | 28 (7.3) | 8 (2) | 36 (9.4) | 0.08 |

**Table 2.** Angiographic findings of patients

| Characteristics | Hypertensive no (%) | Normotensive no (%) | P value |
|---|---|---|---|
| 1-vessel disease | 164 (28) | 111 (29) | 0.7 |
| 2-vessel disease | 143 (24) | 116 (30) | 0.03 |
| 3-vessel disease | 192 (32) | 106 (28) | 0.1 |
| Total (976) | 499 (84) | 333 (87) | |

normotensive ones (44.3% and 32% respectively, P = 0.0001). Smoking was more prevalent in non hypertensive patients than hypertensive ones (54.2% and 28.1% respectively). The groups were similar regarding family history of CAD. As shown in table 1, the proportion of women undergoing coronary angiography in hypertension group was higher than proportion of women in normotensive group (43.8% and 17.8%). This difference was statistically significant (P < 0.0001). Four hundred and ninety nine patients in hypertensive group (84%) and 333 (87%) patients in normotensive group had CAD. Table 2 summarizes the angiographic findings of both groups. In terms of the numbers of stenotic coronary arteries, there was a statistically non significant trend to more prevalence of 3VD in hypertensive group (32% vs. 28%, P = 0.1) and also hypertensive pa-

tients had a lower prevalence of 1-vessel and 2-vessel disease. This difference was statistically significant in 2-vessel disease group (P = 0.03). On investigation of CAD with regard to gender in hypertensive and normotensive groups, 3-vessel disease in hypertensive women was more frequent than normotensive women (37% vs. 18%). This finding was statistically significant (P = 0.02). (Table 3)

There was no statistically significant difference in prevalence of CAD in those with and without hypertension (84% vs. 87%, P = 0.2). In subgroup analysis, the prevalence of CAD among hypertensive and normotensive men was not statistically significant (91% and 92% respectively); interestingly this difference among women was statistically meaningful (78% vs. 63%; P = 0.01).

**Table 3.** Angiographic findings based on sex groups.

| Characteristics | 1-vessel disease | | 2-vessel disease | | 3-vessel disease | | Total Men no (%) | Total Women no (%) | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Men no (%) | Women no (%) | Men no (%) | Women no (%) | Men no (%) | Women no (%) | | | |
| Hypertensive | 90 (30) | 74 (36) | 90 (30) | 53 (26) | 116 (39) | 76 (37) | 296 (36) | 203 (24) | 499 |
| Normotensive | 91 (27) | 20 (47) | 101 (34) | 15 (35) | 98 (33) | 8 (18) | 290 (35) | 43 (5) | 333 |
| Significance | 0.39 | 0.19 | 0.29 | 0.24 | 0.14 | 0.02 | 0.6 | 0.0001 | |

interestingly this difference among women was statistically meaningful (78% vs. 63%; P = 0.01). This implies that CAD was more prevalent among hypertensive women who underwent coronary angiography for suspected CAD.

Prevalence of CAD in the patients with only one risk factor where as follows: 84% in 169 hypertensive, 81% in 11 diabetic, 83% in 36 hyperlipidemic patients, 97% in 125 patients with history of smoking, 81% in 11 patients with familial history of ischemic heart disease and finally 77% in 81 patients who didn't have any risk factors. The difference between these prevalence were significant statistically (P = 0.001).

## Discussion

Numerous epidemiological studies have shown that the presence of hypertension increases the risk of CAD, not only in at risk populations but also in the general population.[2] In the present study the prevalence of hypertension in patients undergoing coronary angiography was high. The prevalence of hypertension for the same age group in general population is 35-40%, therefore the prevalence of 60.9% of hypertension in patients undergoing coronary angiography indicates its important effect in developing CAD. Accumulation of other coronary risk factors in hypertensive patients was also shown, as diabetes mellitus and hyperlipidemia were more frequent in hypertensive patients than in normotensive ones. This is in correlation with results of other studies.[9,10]

Eighty four percent of hypertensive patients in this study had CAD which is in notable contrast as compared with prevalence of 26% in Japanese patients.[5] On the other hand in comparison with Western and European populations, in Rotterdam and the United States the prevalence of CAD was 74% in hypertensive patients and 71% in normotensive patients.[5] This implies that the pattern of CAD in our region is similar to or even more severe than Western populations. With changes in diet and life style habits in populations like Japan, where the prevalence of CAD is low, CAD pattern gets closer to the pattern of Western countries.[11] In

Rotterdam study the prevalence of 1-, 2- and 3-vessel disease was reported to be 34%, 16%, 14% respectively with no significant difference in hypertensive and normotensive patients. However in the present study, 3-vessel diseases (3VD) was the prominent form of disease in hypertensive patients. Prevalence of 3VD was more frequent in hypertensive patients than in normotensive ones.

Higher prevalence of hypertensive women undergoing coronary angiography is also noteworthy. In Rotterdam study 26% of hypertensive group were female; however in the present study they constituted 43.8% of the hypertensive group. The prevalence of normotensive women in the Rotterdam and the present study was not different significantly (20% vs. 17.8%) [7]. This implies the potential strong role of hypertension in developing CAD in women. Comparing results of this study with reports from populations with low prevalence of CAD like as Japan, reveals lower prevalence (47.1%) of hypertension in patients undergoing coronary angiography in those populations. Prevalence of CAD in the same article was reported to be 33.7% which was significantly lower than the prevalence of CAD in the present study (84%). This finding indicates severity of the problem in our population. Considering lower prevalence of diabetes mellitus and hyperlipidemia in our patients compared to the aforementioned studies and similarity of other demographic data, it can be postulated that hypertension has a key role in developing CAD.

Prevalence of 1- and 2-vessel disease was not different between hypertensive and normotensive patients; while 3-vessel disease, the most severe form of CAD, was significantly more frequent in hypertensive women than normotensive ones (37% and 18% respectively). Considering the higher frequency of hypertensive women undergoing coronary angiography and higher prevalence of 3-vessel disease in this group, it seems that hypertensive women in our population are at increased risk and need special attention in blood pressure control and health measures.

In evaluation of prevalence of CAD in patients

with only one risk factor and patients without risk factor smoking had strong association with CAD (97%) and the effect of other risk factors were equal relatively. Surprisingly in patients without risk factors and with signs and symptoms of CAD the prevalence of CAD was high (77%). Is there any other risk factor important in our population?

## Conclusion

Prevalence of hypertension in patients undergoing coronary angiography is high and has a pattern like western countries. Considering high prevalence of hypertensive females with 3-vessel disease, these groups of patients are at increased risk for CAD and its complications which show the need for prompt health measures in control of hypertension. Our strong suggestion is to evaluate other possible risk factors in our population.

Considering lack of systematic health data collection in our region, although there are limitations in clear estimation of prevalence of hypertension, diabetes mellitus and hyperlipidemia, we selected the reliable definitions to find the relatively accurate prevalence of risk factors. Another potential limitation of the study was its retrospective design though this design is not uncommon in descriptive studies.

## Conflict of Interests

Authors have no conflict of interests.

## References

1. Elliott H. Epidemiology, aetiology and prognosis of hypertension. Medicine 2006; 34(8): 286-9.
2. Baguet JP, Barone-Rochette G, Mallion JM. European society of hypertension scientific newsletter: hypertension and coronary heart disease. J Hypertens 2006; 24(11): 2323-5.
3. Pepine CJ. Systemic hypertension and coronary artery disease. Am J Cardiol 1998; 82(3A): 21H-24H.
4. Kato J, Aihara A, Kikuya M, Matsubara M, Ohta M, Ohkubo T, et al. Risk factors and predictors of coronary arterial lesions in Japanese hypertensive patients. Hypertens Res 2001; 24(1): 3-11.
5. Akbarzadeh F, Hejazi E, Kousahvar H, Pezeshkian M. Prevalence of cardiovascular diseases and cardiac risk factors in northwestern Tabriz. Medical Journal of Tabriz University of Medical Sciences 2003; 25(3):11-15.
6. Lembo G, Morisco C, Lanni F, Barbato E, Vecchione C, Fratta L, et al. Systemic hypertension and coronary artery disease: the link. Am J Cardiol 1998; 82(3A): 2H-7H.
7. Fragasso G. Diagnosing coronary artery disease in patients with hypertension: a resolved dilemma? Ital Heart J 2000; 1(11): 726-31.
8. Elhendy A, Van Domburg RT, Sozzi FB, Poldermans D, Bax JJ, Roelandt JR. Impact of hypertension on the accuracy of exercise stress myocardial perfusion imaging for the diagnosis of coronary artery disease. Heart 2001; 85(6): 655-61.
9. Isles CG, Walker LM, Beevers GD, Brown I, Cameron HL, Clarke J, et al. Mortality in patients of the Glasgow blood pressure clinic. J Hypertens 1986; 4(2): 141-56.
10. Stamler J, Wentworth D, Neaton JD. Is relationship between serum cholesterol and risk of premature death from coronary heart disease continuous and graded? Findings in 356,222 primary screenees of the multiple risk factor intervention trial (MRFIT). JAMA 1986; 256(20): 2823-8.
11. Washio M, Sasazuki S, Kodama H, Yoshimasu PK, Liu Y, Tanaka K, et al. Role of hypertension, dyslipidemia and diabetes mellitus in the development of coronary atherosclerosis in Japan. JPN Circ J 2001; 65(8): 731-7.