Correlation of Arterial Hypertension and Type 2 Diabetes Mellitus with Type of Polyvascular Atherosclerotic Disease

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Atherosclerosis is a systemic disease of blood vessels which in most of the cases affects two or three vascular beds. The occurrence and development of atherosclerotic disease is accelerated by multiple risk factors among which the significant role has arterial hypertension and diabetes mellitus. Aim of this article is to evaluate presence of hypertension and diabetes mellitus type 2 in patients with polyvascular atherosclerotic disease and compare them to those who have isolated disease of one vascular bed. Material and methods: we enrolled total of 160 consecutive patients. Patients were divided into 4 groups, in relation to the type of their atherosclerotic disease. COR-group included patients with coronary atherosclerotic disease, CAR-IF group included patients with carotid and iliac-femoral atherosclerotic disease, COR-IF group consists of patients with coronary and iliac-femoral atherosclerotic disease, and COR-CAR-IF group consists of patients with atherosclerotic disease in three vascular beds: coronary, carotid and iliac-femoral. We followed clinical variables: age, gender, arterial hypertension, tobacco smoking, total cholesterol and diabetes mellitus with focus on arterial hypertension and diabetes mellitus. Results: we had significant percentage of patients with arterial hypertension in all four groups in relation to those with normal blood pressure. Hypertension in male subjects was significantly higher in those with polyvascular disease i.e. COR-CAR-IF, and COR-IF groups, compared to monovascular disease i.e. COR group, (p<0.05). In females the prevalence of hypertension was significantly higher in COR-CAR-IF and COR-IF groups, (<0.05). Males had higher systolic values in the COR-CAR-IF group compared to other groups, but only signif. differ. was between COR-CAR-IF group vs. CAR-IF group, (p<0.05). In females we found signif. differ. in systolic values in COR-CAR-IF group compared to COR group, p<0,05. In diastolic values we found no signif. differ. between groups. The significant percentage of diabetics was in COR-CAR-IF group (77.5%), and the difference to other groups was statistically significant, p<0.05. We found significant percentage of diabetics in COR-CAR-IF group (77.5%), and the difference between the diabetics versus non-diabetics was statistically significant. The largest percentage of diabetics both men (76.1%) and women (84.2%) belonged to the patients with polyvascular disease i.e. COR-CAR-IF group respondents. Conclusions: prevalence of arterial hypertension and type 2 diabetes mellitus was statistically higher in individuals with polyvascular atherosclerotic disease. Keywords: hypertension, diabetes mellitus, polyvascular atherosclerotic disease

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1. INTRODUCTION
Polyvascular atherosclerotic disease involves presence of atherosclerotic process in coronary, carotid and peripheral arteries of the lower extremities (1,2). There are no accurate data on the incidence of atherosclerosis, but all epidemiological data suggests worlwide burden of clinical manifestations of atherosclerosis, i.e. coronary heart disease, cerebrovascular disease and peripheral vascular diseases.

Atherosclerosis is a complex disease with many predisposing factors that are called multiple risk factors (MRF) i.e. age, gender, arterial hypertension, tobacco smoking, hyperlipidaemia, obesity, diabetes mellitus (3, 4). Epidemiological studies have unambiguously shown that hypertension is major risk factor for cardiovascular disease. High blood pressure can be well in advance indicator of cardiovascular cases, including monovascular atherosclerotic disease.
disease where we have one vascular bed affected or polyvascular atherosclerotic disease with two or three vascular beds affected (5). Several mechanisms may explain the hypertension-induced atherosclerosis. Stretching of the blood vessel wall caused by pressure increases endothelial permeability lipoprotein density and increases the accumulation of low density lipoprotein in the intima that has a central role in atherogenic process (6,7).

Hypertension also promotes or aggravates endothelial dysfunction, and the present understanding of the pathophysiology of atherosclerosis suggests that changes in endothelial function play a major role in the development and progression of atherosclerosis and its clinical complications. Monocytes adhesion, an early marker of atherosclerosis, is enhanced as a result of hypertension (8).

Epidemiological studies have also shown that diabetes mellitus is strong and independent risk factor for cardiovascular disease. Coronary heart disease is the cause of the large number of deaths in patients with diabetes who have doubled up to fourfold increased risk of coronary heart disease. Patients with diabetes also have unfavorable long-term prognosis after myocardial infarction, including increased rates of re-infarction, congestive heart failure and death (9,10).

Epidemiological evidence confirms the link between diabetes and increased prevalence of diseases of the peripheral blood vessels. Individuals with diabetes have twice to fourfold increase in diseases of the peripheral blood vessels, often with obstruction and lack of femoral pulse, and the rate of disordered brachial index that varies from 11.9% to 16%. The duration and severity of diabetes is associated with the incidence and extent of disease of the peripheral blood vessels (11,12).

The frequency of diabetes among patients who had experienced a stroke is three times higher than selected control individuals. The risk of heart attack was increased from 150 to 400% for patients with diabetes and increased blood glucose levels is directly related to the risk of stroke (13,14,15,16,17).

2. AIM
The goal of this article is to evaluate the presence of hypertension and diabetes mellitus type 2 in patients with polyvascular atherosclerotic disease and compare them with those who have isolated disease in one vascular system.

3. MATERIAL AND METHODS
The study was prospective clinical study with 4 groups of subjects divided in relation to the localization of their atherosclerotic process. The study was conducted on a sample of 160 respondents who are treated on hospital basis in the Clinical Center in Sarajevo at the Clinic of Heart Disease and Rheumatism, and the Institute of Vascular Diseases. All respondents were divided into 4 groups, first group includes the patients with documented atherosclerotic changes in coronary vascular system (COR-group), the second group includes the patients with documented atherosclerotic changes in coronary and iliac-femoral vascular (CAR-IF-group), the third group consists of patients with atherosclerotic changes in coronary and iliac-femoral vascular system (COR-IF-group), the fourth group consists of patients with documented atherosclerotic vascular changes in three systems: coronary, carotid and iliac-femoral vascular system (COR-CAR-IF group). Each group was consisted of 40 respondents.

Statistical data processing
Statistical analysis included tests of the standard descriptive statistics (mean, median, standard deviation) and tests (t-test, X² test and correlation).

Differences of continuous data between groups who did not follow a normal distribution were analyzed by Kruskal-Wallis test followed by Mann-Whitney test. The p-value less than 0.05 are considered as statistically significant.

4. RESULTS
In all observed groups of respondents noticed are a higher percentage of men in relation to women. In a group of respondents with isolated atherosclerotic changes in coronary blood vessels, as well as in the group with atherosclerotic changes in carotid and iliac-femoral blood vessels, was a significantly higher percentage of men, (p <0.05). The average age of respondents in the COR group was 51.4±4.3, in the CAR-IF group 57.2±7.6, in the COR-IF group 59.1±9.8, and COR-CAR-IF 64.6±3.4 years. Respondents of both genders in the COR-CAR-IF group were significantly older than those in the COR and CAR-IF groups (p<0.05). It was also found that only male respondents in the CAR-IF and IF-COR group are significantly older than those in the COR group (p<0.05). There were no significant differences in age of respondents of both sexes between CAR-COR-IF and COR-IF groups. The COR group of respondents have significantly greater percentage of respondents younger than 59 years (95%) than in subjects older than 59 years (5%) and we found the difference that is statistically significant (p<0.05). in the COR-CAR-IF group of respondents, a statistically significantly higher is percentage of respondents older than 59 years (90%) (Table 1).

Analyzing the gender structure of respondents noticed are a higher percentage of men in relation to women. In a group of respondents with isolated atherosclerotic changes in coronary blood vessels, as well as in the group with atherosclerotic changes in carotid and iliac-femoral blood vessels, was a significantly higher percentage of men, (p <0.05). The average age of respondents in the COR group was 51.4±4.3, in the CAR-IF group 57.2±7.6, in the COR-IF group 59.1±9.8, and COR-CAR-IF 64.6±3.4 years. Respondents of both genders in the COR-CAR-IF group were significantly older than those in the COR and CAR-IF groups (p<0.05). It was also found that only male respondents in the CAR-IF and IF-COR group are significantly older than those in the COR group (p<0.05). There were no significant differences in age of respondents of both sexes between CAR-COR-IF and COR-IF groups. The COR group of respondents have significantly greater percentage of respondents younger than 59 years (95%) than in subjects older than 59 years (5%) and we found the difference that is statistically significant (p<0.05). in the COR-CAR-IF group of respondents, a statistically significantly higher is percentage of respondents older than 59 years (90%) (Table 1).

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### Table 1. Age and gender structure of the respondents

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<th>F</th>
<th>No</th>
<th>%</th>
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<td>62.5</td>
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### Table 2. Presence of hypertension and diabetes mellitus in relation to the respondent’s gender

<table>
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</thead>
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</table>
patients with hypertension according to groups, we can see that the hypertension was approximately equally distributed in both sexes in all groups with the exception of the COR group where there was a statistically significant difference in the representation of risk factors (89.2% men). (Table 2). Diabetes mellitus as a risk factor we had not found in women in COR group and a statistically significant differences in the representation of risk factors seen from the aspect of gender exists only in patients from COR -IF group (p<0.05).

Largest percentage of respondents with hypertension was in the COR-CAR-IF group (95%), and COR-IF (85%) groups and the lowest (65%) was in the CAR-IF group. Analyzing the presence of hypertension as a risk factor, we can see that is statistically significantly higher percentage of subjects with hypertension compared to normal BP values in all four groups of subjects (p<0.05) (Table 3).

The largest percentage of patients with hypertension both men (95.2%) and women (94.7%) were in the COR-CAR-IF group. For males with hypertension smallest percentage (50%) was in the CAR-IF-group, and the lowest percentage of women with hypertension (42.8%) was in the COR-group. Presence of hypertension in male subjects was significantly higher in CAR-COR-IF and COR-IF group compared to the CAR-IF group (p<0.05). For female subjects it was found that the prevalence of hypertension was significantly higher in CAR-COR-IF, CAR-IF, and COR-IF group compared to the COR-group (p<0.05) (Figure 1).

The largest percentage of respondents with hypertension younger than 59 years (96.4%) was in the COR-group, and the lowest percentage in the same age group (7.8%) was in the COR-CAR-IF group. Largest percentage of respondents with hypertension older than 59 years (92.2%) was in the COR-CAR-IF-group, and the lowest percentage of respondents with hypertension older than 59 years (3.6%) was in the COR-group. We found a statistically significant difference of hypertension among respondents younger than 59 years in COR and CAR-IF group compared to the COR-IF and COR-CAR-IF groups (p<0.05), while significant differences exist in the presence of the respondents with hypertension older than 59 years of COR-IF and COR-CAR-IF group compared to the COR and CAR-IF group (p<0.05) (Figure 2).

Post Hoc tests determined that the average value of systolic and diastolic blood pressure in male subjects was significantly higher in CAR-COR-IF group compared to the CAR-IF group (p<0.05). Male respondents had significantly lower average values of both systolic and diastolic blood pressure in the CAR-IF group compared to the COR and COR-IF group (p<0.05). In case of female respondents difference in systolic and diastolic blood pressure between groups was not significant (p>0.05) (Figure 3 and 4).

The largest percentage of respondents with diabetes was in COR-CAR-IF subgroup in comparison to other subgroups, p<0.05. In younger patients we had a reverse proportion to be observed in relation to gender,
the largest percentage of respondents with diabetes of both men (76.1%) and women (84.2%) belonged to the COR-CAR-IF-group of respondents. There is a statistically significant difference in the representation of diabetic patients of both sexes in COR-CAR-IF group in comparison to other groups. (p < 0.05) (Table 5).

The largest percentage of diabetic patients younger than 59 years (100%) belonged to the COR-group. There is a statistically significant difference in the representation of diabetic patients younger than 59 years in the COR group in comparison to other groups (p < 0.05). The largest percentage of diabetic patients older than 59 years (93.5%) was in the COR-CAR-IF-group so there is established a statistically significant difference in the representation of this group of diabetic patients in comparison to other groups (p < 0.05). (Figure 5).

5. DISCUSSION

Atherosclerosis is a systemic disease of blood vessels and in most of the cases affects several vascular beds. It was noted that every sixth person has localized atherosclerotic process in coronary, carotid and iliaco-femoral blood vessels, with a localized symptomatic atherosclerotic process in one or two or three vascular systems i.e. vascular beds.

Cardiovascular risk factors are introduced as a term by Framingham Heart Study. They include the characteristics or symptoms that occur in the population, which are significantly associated with increased prevalence, incidence, morbidity and mortality from atherosclerotic disease.

Development of atherosclerosis is significantly accelerated if someone has several risk factors simultaneously with two or more risk factors multiply, rather than their combined effects (6,7,8).

Cardiovascular diseases have the greatest impact on lost years of life, the lost quality of life, as well as differences in the life expectancy between different population groups. In the last decade atherosclerosis was among the 3 leading causes of morbidity and mortality.

Arterial hypertension is well known major risk factor for cardiovascular morbidity and mortality in developed countries, as well as in developing countries. The relative risk of cardiovascular events are associated with severe forms of arterial hypertension which is high and for coronary heart disease is 6.4, and for cerebrovascular disease even 19.2.

Most studies that have analyzed the impact of risk factors for the burden of atherosclerosis disease suggests that arterial hypertension with tobacco smoking and hyperlipoproteinemia is a strong predictor of all cause vascular death. Van der Meer et al. (14) analyzed risk factors and progression of atherosclerosis and found that hypertension, age, tobacco smoking, obesity, total cholesterol and diabetes mellitus are strong and independent predictors of polyvascular atherosclerotic disease occurrence. More than 50% of patients who had a heart attack or even two thirds who had a stroke suffer from hypertension (15). In our study results shows that there are a statistically significantly higher percentage of subjects with hypertension compared to persons with normal blood pressure in all four groups of respondents. Our results also shows a higher percentage of hypertension in individuals with two or three vascular beds affected.

Diabetes mellitus, especially type 2, is also a major risk factor for atherosclerotic disease. The frequency and intensity of atherosclerotic disease significantly increased in diabetic patients. Three-quarters of diabetics die from causes associated with macrovascular atherosclerosis and almost half of them have coronary heart disease in clinical form of monovascular disease or in combination with carotid artery disease or iliaco-femoral artery disease. Specific role of diabetes mellitus is in fact that strongly accelerate all other risk factors i.e. hypertension, tobacco smoking and cholesterol. (7,9,10,14).

In our groups of patients with polyvascular atherosclerotic disease has been observed significantly higher representation of diabetes mellitus type 2 in relation to monovascular disease group. International REACH study showed results similar to ours, i.e. the type 2 diabetes mellitus is present in a lower percentage among patients with coronary heart disease. Also, the average age of respondents was significantly less compared to other groups of respondents. In our study diabetes mellitus type 2 as a risk factor was a strong predictor of severe progression of atherosclerosis process i.e. atherosclerosis of carotid, iliac-femoral and coronary arteries. (16,17)

Clinical implications: this evaluation emphasis importance of accurate
identification of multiple risk factors in targeted groups of patients, especially those with arterial hypertension and Diabetes mellitus type 2. Patients with arterial hypertension and diabetes mellitus type 2 are in higher and significant percentage prone to polyvascular atherosclerotic disease. Thus, preventive and therapeutic measures has to be intensive and continuous (7,9,10,11,12,17).

6. CONCLUSIONS

Hypertension in male subjects was significantly higher in those with polyvascular disease i.e. COR-CAR-IF, and COR-IF groups, compared to monovascular disease i.e. COR group, (p<0.05). In females the prevalence of hypertension was significantly higher in COR-CAR-IF and COR-IF groups, <0.05).

Males had higher systolic values in the COR-CAR-IF group compared to other groups, but only signif. differ. was between COR-CAR-IF group vs. CAR-IF group, (p<0.05). In females we found signif. differ. in systolic values in COR-CAR-IF group compared to other groups, but only signif. differ. was between COR-CAR-IF group vs. CAR-IF group, (p<0.05). In diastolic values we found no signif. differ. between groups. The largest percentage of diabetics was in COR-CAR-IF group (77.5%), and the difference to other groups was statistically significant, p<0.05. The largest percentage of diabetics both men (76.1%) and women (84.2%) belonged to the patients with polyvascular disease i.e. COR-CAR-IF group respondents.

Prevalence of arterial hypertension and type 2 diabetes mellitus was statistically higher in individuals with polyvascular atherosclerotic disease.

Assessment of risk factors for the occurrence of atherosclerosis is of paramount importance in order to determine preventive measures and therapeutic interventions. Arterial hypertension and hyperglycemia as changeable risk factors whose prevalence can be significantly reduced by lifestyle changes and medical therapy and consequently prevent the progression of atherosclerotic process especially polyvascular atherosclerotic disease.

REFERENCES


