

PREVALENCE AND SIGNIFICANCE OF DIABETES IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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SUMMARY

Data from the World Health Organization show that there is an increase in the morbidity and mortality caused by ischemic coronary disease. Diabetes has been confirmed as an independent risk factor in the development of coronary disease. The aim of this study was to determine the effect and role of diabetes mellitus in patients suffering from acute myocardial infarction (AMI). The study included 506 patients treated for AMI at Department of Medicine, Cantonal Hospital in Zenica during 1991, 1993 and 1996. In total, there were 94 diabetic patients with AMI: 36 in 1991; 31 in 1993; and 27 in 1996. In the same years, 412 nondiabetic patients were treated for AMI: 127 in 1991; 143 in 1993; and 142 in 1996. The percentage of patients with AMI was significantly higher in the group of diabetics than in nondiabetics ($p < 0.01$). The percentage of women with AMI was significantly higher among diabetics than among nondiabetics in

all three study years (1991 and 1993, $p < 0.01$; 1996, $p < 0.05$). Among nondiabetics, the percentage of AMI was significantly higher in men as compared with women in all three study years ($p < 0.001$). The percentage of diabetics with AMI did not change significantly among the three study years.

INTRODUCTION

Diabetes is a chronic non-communicable disease widespread around the world. A global epidemic of diabetes is expected (1). According to data from 1992, in the region of Zenica there were 2573 registered patients suffering from diabetes; however, the number is estimated to be twice as high, and the prevalence in that year was 2.5%. According to estimates, in the Zenica-Doboj Canton there are 18000-20000 people with glucose tolerance disorders. At Department of Internal Diseases, Cantonal Hospital in Zenica, diabetic patients accounted for 2.7% of treated patients in 1969, to rise to 15.5% in 1992, whereas in the first quarter of 1999, the number of diabetics ranged from 20% to 35% of the total number of patients treated at the Department.

In the Framingham study, the incidence of cardiovascular diseases in diabetic men was twofold that in nondiabetic men, and in diabetic women it was

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threefold that in nondiabetic women (2). Data from the Public Health Institute of the Federation of Bosnia-Herzegovina (FBiH), cardiovascular diseases are highly prevalent in the morbidity of the population above 19 years of age (4). In Zenica region, the situation is similar. Out of the total number of patients treated at our Department, cardiovascular patients accounted for 36.4% in 1979, 49.33% in 1991, and 44.42% in 1996, with 22.92% of cardiovascular patients being diabetics in 1991, 13.29% in 1993, and 7.74% in 1996.

According to epidemiological characteristics, percentage of morbidity, early disability and mortality, ischemic heart disease represents a very serious sociomedical problem in the majority of countries. Data from the World Health Organization show that there is an increase in the morbidity and mortality due to ischemic heart disease. In the USA and some other western countries, a drop in the rate of ischemic heart disease has been recorded due to a large-scale campaign for reduction of risk factors. Diabetes has been confirmed to be an independent risk factor for the occurrence of coronary disease. The link between diabetes and coronary disease has been known for some 70 years (5). A risk for diabetics to suffer from coronary diseases is 2-4 times higher than in nondiabetics (6). Patients treated for ischemic heart disease at our Department accounted for 9.29% of the total number of patients with cardiovascular diseases in 1991, 6.11% in 1993, and 16.4% in 1996. Of these, 44.78% were diabetics with coronary disease in 1991, 49.27% in 1993, and 46.66% in 1996.

Epidemiological studies confirm that there is an increase in the prevalence of acute myocardial infarction (AMI) in general (7). In general, diabetics have a significantly higher prevalence of AMI than nondiabetics. Lately, a significant drop in the incidence (and mortality) due to myocardial infarction has been recorded in industrialized countries (25%-30%), mainly due to better preventive measures and better treatment. In BiH, there are no data on the incidence and mortality caused by ischemic heart disease (and AMI). The percentage of diabetics with AMI treated at our Department was 8.6% in 1974, 12.2% in 1975, and 14.2% in 1976.

The aim of this study was to determine the effect and role of diabetes mellitus in patients suffering from AMI, treated at our Department during 1991, 1993 and 1996.

PATIENTS AND METHODS

The study included 506 patients treated for AMI at Coronary Unit of the Department during 1991 (n=163), 1993 (n=174) and 1996 (n=169). In total, there were 412 (81.42%) nondiabetics with AMI in the three study years: 127 (77.91%) in 1991; 143 (82.18%) in 1993; and 142 (84.02%) in 1996.

There were 94 (18.58%) patients with diabetes type 1 or 2 who were treated for diagnosed AMI during three study years: 36 (22.09%) in 1991; 31 (17.82%) in 1993; and 27 (15.98%) in 1996.

We used the European standards from 1993 to diagnose diabetes mellitus, i.e. fasting venous blood glucose of 6, 7 or more mM/L, or randomly measured glycemia of 10.0 mM/L or more at any time during the day (8). The diagnosis of diabetes type 1 was based on clinical and laboratory parameters. Clinical parameters included acute onset of the disease, normal or reduced body weight or loss of weight, onset of diabetes in younger age, i.e. before age 30, polyuria, presence or proneness to ketoacidosis, and insulin therapy required immediately or shortly after the disease diagnosis (3,9). Laboratory parameters included determination of glycemia and acetonuria. Glycemia was determined by the glucose oxidase method on a Technicon 1000 RA device, and acetonuria by use of Bayer Multistix strips.

The same approach was employed to diagnose diabetes mellitus type 2. The following clinical parameters were used: slow onset disease, obesity, normal or increased body weight in those affected, disease onset at a later age (over 30), absent or occasional ketoacidosis, and no need of insulin at the beginning of the disease (3,9). Laboratory parameters included determination of glycemia and acetonuria as described for diabetes mellitus type 1.

The diagnosis of AMI was based on clinical picture, electrocardiography (ECG) at admission, values of relevant enzymes, and echocardiography in unclear cases. ECG and values of the CPK, LDH and AST enzymes were regularly performed in these patients until discharge from the hospital. In addition, glycemia, acetonuria, triglycerides, cholesterol, etc. were monitored as well, as required by medical indications and possibilities.

Data on the study patients were collected from medical records (history) kept at Department, and those that were missing or incomplete in their medical histories were collected directly from the patients or their close relatives.

This study was of a retrospective design. Patient age ranged from 40 to 79 years. The mean duration of diabetes prior to the occurrence of AMI was 10.0 (SD 6.61) years in 1991, 7.3 (SD 4.78) years in 1993, and 9.0 (SD 5.88) in 1996.

RESULTS

Table 1 shows total number and percentage of patients treated at our Department in the three study years.

The upper part of Table 2 shows number and percentage of diabetics and nondiabetics treated for AMI in total and according to year of hospitalization. The lower part of Table 2 shows number of diabetics and nondiabetics without AMI in the same years. Differences in the percentage of diabetics with AMI among the three study years were not statistically significant (22.09% in 1991 vs 17.82% in 1993 vs 15.98% in 1996).

Table 3 shows all diabetics and nondiabetics according to sex and year of hospitalization.

Table 4 shows number and percentage of patients with AMI according to sex (in relation to total of 1334 treated diabetics and 8059 nondiabetics; see Table 3).

Table 1. Patients hospitalized during three study years

Hospitalized patients		Total		Year of hospitalization		
		N	%	1991	1993	1996
Diabetic	n	1334	14.2	551	391	392
	%			15.5	13.2	13.6
Nondiabetic	n	8059	85.8	3004	2568	2487
	%			84.5	86.8	86.4
Total	N	9393	100	3555	2959	2879
	%			100	100	100

Table 2. Distribution of patients hospitalized during three study years according to the presence/absence of acute AMI

Hospitalized patients		Total		Year of hospitalization					
		N	%	1991		1993		1996	
With acute MI	Diabetic	94	18.58	36	22.09	31	17.82	27	15.98
	Nondiabetic	412	81.42	127	77.91	143	82.18	142	84.02
	Total	506	100	163	100	174	100	169	100
Without acute MI	Diabetic	1240	14	515	15.2	360	13	365	13.5
	Nondiabetic	7647	86	2877	84.8	2425	87	2345	86.5
	Total	8887	100	3392	100	2785	100	2710	100

Table 3. Distribution of diabetic and nondiabetic patients according to sex and year of hospitalization

Hospitalized patients		Total		Year of hospitalization					
		N	%	1991		1993		1996	
Diabetic	Male	514	8.53	217	39.38	165	42.2	132	33.67
	Female	820	61.47	334	60.62	226	57.8	260	66.33
	Total	1334	100	551	100	391	100	392	100
Nondiabetic	Male	3985	9.45	1424	47.4	1373	3.47	1188	7.77
	Female	4074	0.55	1580	2.6	1195	6.53	1299	2.23
	Total	8059	100	3004	100	2568	100	2487	100

Table 4. Distribution of diabetic and nondiabetic AMI patients according to sex and year of hospitalization

Hospitalized patients		Total		Year of hospitalization					
		N	%	1991		1993		1996	
				n	%	n	%	n	%
Diabetic	Male	41	7.98	17	7.83	13	7.88	11	8.33
	Female	53	6.46	19 ^c	5.69	18 ^d	7.96	16 ^e	6.15
	Total	94 ^a	7.05	36 ^b	6.53	31	7.93	27	6.89
Nondiabetic	Male	296	7.43	96 ^f	6.74	104 ^g	7.57	96 ^h	8.08
	Female	116	2.85	31 ^{c,f}	1.96	39 ^{d,g}	3.26	46 ^{e,h}	3.54
	Total	412 ^a	5.11	127 ^b	4.23	143	5.57	142	5.71

a,c,d (p<0.01)

b,e (p<0.05)

f,g,h (p<0.001)

The upper part of Table 4 shows data on diabetics and the lower part data on nondiabetics with AMI treated at Coronary Unit in the three study years.

The percentage of patients with AMI was statistically significantly higher in the group of diabetics (7.05%) in comparison to nondiabetics (5.11%) ($\chi^2=8.824$; $p<0.01$). In 1991, the percentage of AMI was significantly higher among diabetics than in nondiabetics ($\chi^2=5.983$; $p<0.05$). In 1993 and 1996, there were no statistically significant differences.

The percentage of women with AMI was significantly higher in the group of diabetics as compared with the group of nondiabetics in all three study years ($\chi^2=15.303$; $p<0.01$ in 1991; $\chi^2=11.131$; $p<0.01$ in 1993; and $\chi^2=4.436$; $p<0.05$ in 1996).

Analysis of differences in the percentage of diabetics with AMI according to year of hospitalization and sex yielded no statistically significant results. However, in nondiabetics there were statistically significant sex differences, with a significantly higher percentage of AMI in men than in women in all three study years ($\chi^2=42.75$ in 1991; $\chi^2=23.317$ in 1993; and $\chi^2=23.464$ in 1996; $p<0.001$ all).

DISCUSSION

This study of the prevalence of diabetes in a sample of AMI patients included patients who were previously diagnosed with diabetes as well as those where clinical and laboratory parameters clearly indicated the presence of diabetes although they were unaware of it. Individuals with newly diagnosed hyperglycemia but with no reliable clinical and laboratory indicators of

the presence of diabetes were not included in this study but in another one designed for additional evaluation of new hyperglycemia.

Out of 506 patients treated for AMI in the three study years, there were 94 (18.58%) diabetics. In 1991, there were 36 (22.09%) diabetics out of 163 patients treated for AMI; in 1993, there were 31 (17.82%) diabetics out of 174 patients treated for AMI; and in 1996, there were 27 (15.98%) diabetics out of 169 patients treated for AMI.

Several authors report on the prevalence of diabetes in AMI patients ranging from 8% to 18% (10-12). Some authors report that diabetes increases the risk of AMI. According to one study, diabetes as a risk factor was present in 10%-24% of patients with AMI (13). Among patients with AMI, the percentage of diabetes in an ethnic group was 54%, whereas in another one it ranged from 21.6% to 33% (14-16).

Therefore, there is an extreme inconsistency in the prevalence of diabetes among AMI patients worldwide; data are ranging between 9.7% and 25.6% (17). The prevalence of diabetes among those with AMI varies in different reports from 6% to 22%, probably due to different parameters used on diagnosing diabetes (18).

Out of the total number of our patients treated for AMI, there were 22.09% of diabetics in 1991, 17.82% in 1993, and 15.98% in 1996. The prevalence of diabetes (mean 18.58% for all three study years) among patients with AMI recorded in our patient sample was in accordance with literature data; although varying in percentage, in most reports it ranges from 8% to 25.6%. The percentage of diabetics with AMI found in three study years (1991, 1993 and 1996) did not change significantly.

Furthermore, we analyzed the prevalence and differences in the prevalence of AMI in the groups of diabetics and nondiabetics treated at our Department in three study years. The percentage of patients with AMI in the group of 1334 diabetics was 7.05% and was significantly higher than the percentage of patients with AMI (5.11%) in the group of 8059 nondiabetics treated at our hospital during the same period (Tables 3 and 4).

Numerous literature reports confirm that the occurrence of AMI is more common in diabetics than in nondiabetics (19-32). Therefore, like other authors, we also found AMI to be significantly more common in the group of diabetics than in the group of nondiabetics.

We were interested in the prevalence and differences in the prevalence of AMI between diabetic and nondiabetic women, and diabetic and nondiabetic men. We found statistically significant differences in all three study years between diabetic and nondiabetic women with AMI (5.69% vs 1.96% in 1991; 7.96% vs 3.26% in 1993; $p < 0.01$ both; and 6.15% vs 3.54% in 1996, $p < 0.05$). In men, however, there were no statistically significant differences (Tables 3 and 4).

Diabetics have a significantly higher prevalence of AMI than nondiabetics in total and by sex (30-32). In the Strong Heart Study, the prevalence of definitive AMI and definitive heart disease was higher in men than in women, as well as in diabetics (31). A study from 1979 (Kannel & McGee, 20-year data from Framingham) reports that diabetic men and women had a greater than 50% and 20% increase in the incidence of coronary disease compared to nondiabetic individuals (33-36). In women, diabetes reduces relative protection from ischemic heart disease which they have until menopause (37). The prevalence of AMI was 16.5% and 9.7% in diabetic and nondiabetic men, and 17.7% and 4% in diabetic and nondiabetic women, respectively (38). In diabetics, the percentage of AMI is increased in all age groups. Among middle-aged adults, AMI is twice as common in diabetic as in nondiabetic male population, and three times as common in diabetic as in nondiabetic female population (39).

According to our results, diabetic women suffered more frequently from AMI than nondiabetic women, which is in accordance with these literature reports. Still, compared to nondiabetic men, men from our group of diabetics suffered more frequently from AMI but the difference was not statistically significant. According to literature reports, diabetic men suffer much more frequently from AMI than nondiabetic men, and the lack of statistically significant difference in our study might be the consequence of lower exposure of diabetic men to other risk factors of coronary disease, having in mind that diabetic men were smokers and alcohol consumers in a much lower percentage than nondiabetic men and had a better socioeconomic status. An equal influence of war on both groups is questionable because diabetic men were often spared from some responsibilities and dangerous tasks during the 1992-1995 war in Bosnia.

Finally, we wanted to find out if there were differences in the prevalence of AMI between women and men in the groups of diabetics and nondiabetics. There were no statistically significant differences in the percentage of diabetic men and women suffering from AMI in any of the study years. Still, in the groups of hospitalized nondiabetic men and women there were statistically significant differences in the percentage of men with AMI in all three study years, which was much higher in comparison with women from the same group ($p < 0.001$) (Table 4).

It has been definitely established that the probability of AMI is higher in diabetic women than in men (10,22,40-42). The prevalence of AMI in diabetic women is higher than in diabetic men (31,32), however, there also are opposite reports (30). Contrary to the general population, the risk of AMI was found to be the same in diabetic women and men (19). The prevalence of AMI in nondiabetic population is higher in men than in women (30-32). In our study of diabetics with AMI, we found no statistically significant differences in the prevalence of AMI between men and women. However, the prevalence of AMI was significantly lower in nondiabetic women than in nondiabetic men, which is consistent with literature data.

In conclusion, the mean prevalence of diabetes among those suffering from AMI was 18.58%, while the percentage of diabetics with AMI treated at the hospital did not change significantly during the three study years. During the three study years, the percentage of AMI patients among diabetics was significantly higher than the percentage of AMI

patients among nondiabetics (7.05% vs 5.11%). The percentage of diabetic women suffering from AMI was statistically significant and was higher than the percentage of nondiabetic women suffering from AMI. In nondiabetic patients with AMI, women suffered significantly less from AMI than men.

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