Atherosclerosis 242 (2015) 123–127

Contents lists available at ScienceDirect

Atherosclerosis

journal homepage: www.elsevier.com/locate/atherosclerosis

Inverse association between diabetes and aortic dilatation in patients with advanced coronary artery disease

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ARTICLE INFO

Article history:
Received 6 March 2015
Received in revised form
29 May 2015
Accepted 7 July 2015
Available online 10 July 2015

Keywords:
Diabetes
Aortic dilatation
Advanced coronary artery disease

ABSTRACT

Background: A negative association between diabetes and abdominal aortic aneurysm has recently been reported. The purpose of this study was to assess the relationship between diabetes and aortic diameter, including non-aneurysmal aortic diameter, in patients with advanced coronary artery disease.
Methods: We identified 351 consecutive patients who had undergone coronary artery bypass graft surgery. The patients were divided into two groups: those with diabetes mellitus (DM) (DM+ group; n = 180), and those without DM (DM− group; n = 171). Infrarenal and ascending aortic diameters were measured by preoperative computed tomography and corrected for body surface area.
Results: Infrarenal and ascending aortic diameters were significantly shorter in the DM+ group than in the DM− group (21.3 ± 5.0 mm vs. 24.7 ± 9.8 mm, $p < 0.001$ and 36.0 ± 4.4 mm vs. 37.8 ± 5.5 mm, $p = 0.001$, respectively). The rates of infrarenal aortic diameter ≥30 mm and ascending aortic diameter ≥40 mm were significantly lower in the DM+ group than in the DM− group (3.5% vs. 13.3%, $p = 0.003$ and 14.2% vs. 24.1%, $p = 0.025$, respectively). Multivariate models demonstrated diabetes to be an independent predictor of both infrarenal and ascending aortic diameters even after correction for body surface area.
Conclusion: Our findings indicated an inverse association between diabetes and aortic dilatation of both the infrarenal and ascending aorta in patients with advanced coronary artery disease.

1. Introduction

Recent reports have suggested an unusual relationship between diabetes and abdominal aortic aneurysm (AAA) [1,2]. Diabetes is associated with an increased risk of developing atherosclerosis, and AAA was traditionally considered to be related to atherosclerotic disease; however, prevalence studies have suggested that patients with diabetes might have a lower AAA prevalence, and furthermore, prospective incidence studies suggest a lower probability of AAA development in diabetic patients than in non-diabetic patients [3]. However, data regarding this issue are limited, especially in selected patients.

While some screening studies have reported the prevalence of AAA in patients with coronary artery disease [4–7], the association between diabetes and AAA among those patients was not focused on. Furthermore, the association with non-aneurysmal aortic diameter has not been fully elucidated.

The purpose of this study was to assess the relationship between diabetes and both ascending and abdominal aortic diameters, including non-aneurysmal aortic diameter, in patients with advanced coronary artery disease.

2. Methods

2.1. Patients

We identified 351 consecutive patients who underwent coronary artery bypass grafting (CABG) at our institution between January 2009 and December 2012. The 351 patients were divided into two groups: those with diabetes mellitus (DM) (DM+ group; n = 180), and those without DM (DM− group; n = 171). The criteria

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http://dx.doi.org/10.1016/j.atherosclerosis.2015.07.016
0021-9150/

for DM were met if patients had hemoglobin A1c levels (National Glycohemoglobin Standardization Program) ≥6.5%, a fasting plasma glucose concentration > 126 mg/dL, and/or a history of antihyperglycemic medication or a previous diagnosis of diabetes.

This study was performed according to the guidelines of the Declaration of Helsinki and was approved by the local Ethics Committee, which waived the requirement for written informed consent.

Infrarenal and ascending aortic diameters were measured by thoracoabdominal computed tomography, performed as a preoperative evaluation before CABG, when each site had no history of surgical repair and axial images with contiguous 5.0-mm-thick sections of the entire length were available. The short axial diameters of the outer contour were measured at all sections, and the largest short axial diameters of the infrarenal aorta and ascending aorta were derived respectively [8]. The value (aortic diameter/body surface area) was also calculated in order to correct the aortic diameter for body surface area as recent reports have proposed [9–11].

2.2. Statistical analysis

Data are presented as mean ± SD. Categorical variables are expressed as counts and percentages. Continuous data were compared by the unpaired *t*-test. Categorical data were compared using the chi-square or Fisher exact test. Associations between clinical variables and aortic diameter/body surface area were calculated by univariate linear regression analyses. Of them, the factors with $p < 0.1$ in the univariate analyses were entered into a multivariate linear regression analysis. A p-value < 0.05 was considered statistically significant. All analyses were performed using the SPSS 18.0 software package (SPSS, Chicago, IL, USA).

3. Results

The baseline characteristics of all patients are shown in Table 1. No significant differences were observed between the two groups with regard to age, sex, presence of hypertension, dyslipidemia, or smoking status. Mean body mass index and body surface area were significantly larger in the DM+ group than in the DM− group. The mean estimated glomerular filtration rate in the DM+ group was significantly lower than that in the DM− group, and the rate of hemodialysis was higher in the DM+ group. There were no significant differences in the rates of previous abdominal aortic surgery and previous ascending aortic surgery between the two groups.

The intra- and inter-observer variabilities of the infrarenal aorta and ascending aorta in computed tomography images were well correlated (intra-: $r = 0.99$ [$p < 0.001$] and $r = 0.99$ [$p < 0.001$], inter-: $r = 0.99$ [$p < 0.001$] and $r = 0.98$ [$p < 0.001$]).

Measurement results of the largest short axial diameter of the infrarenal aorta are shown in Table 2. Excluding patients with prior abdominal aortic surgery, measurements were obtained in 144 DM+ patients and 135 DM− patients. The mean infrarenal aortic diameter was significantly shorter in the DM+ group than in the DM− group (21.3 ± 5.0 mm vs. 24.7 ± 9.8 mm, $p < 0.001$). The rate of infrarenal aortic diameter ≥30 mm was significantly lower in the DM+ group than in the DM− group (3.5% vs. 13.3%, $p = 0.003$). The value (infrarenal aortic diameter/body surface area) was also significantly smaller in DM+ group than in DM− group (13.1 ± 2.9 mm/m^2 vs. 15.7 ± 6.2 mm/m^2, $p < 0.001$).

Measurement results of the largest short axial diameter of the ascending aorta are shown in Table 3. Excluding patients with prior ascending aortic surgery, measurements were obtained in 162 DM+ patients and 158 DM− patients. The mean ascending aortic diameter was significantly shorter in the DM+ group than in the DM− group (36.0 ± 4.4 mm vs. 37.8 ± 5.5 mm, $p = 0.001$). The rate of ascending aortic diameter ≥40 mm was significantly lower in the DM+ group than in the DM− group (14.2% vs. 24.1%, $p = 0.025$). The value (ascending aortic diameter/body surface area) was also significantly smaller in DM+ group than in DM− group

Table 1
Baseline patient characteristics.

	DM+	DM−	p-value
	n = 180	n = 171	
Age, y	67.5 ± 8.7	69.4 ± 9.5	0.06
Male, n (%)	137 (76.1%)	128 (74.9%)	0.78
Hypertension, n (%)	128 (71.1%)	114 (66.7%)	0.37
Dyslipidemia, n (%)	140 (77.8%)	127 (74.3%)	0.44
Current smoking, n (%)	52 (28.9%)	36 (21.1%)	0.09
Peripheral artery disease, n (%)	29 (16.1%)	15 (8.8%)	0.04
Prior abdominal aortic surgery, n (%)	4 (2.2%)	3 (1.8%)	1.00
Prior ascending aortic surgery, n (%)	0 (0%)	3 (1.8%)	0.12
Family history of cardiovascular disease, n (%)	21 (11.7%)	27 (15.8%)	0.26
Family history of aortic aneurysm, n (%)	1 (0.6%)	2 (1.2%)	0.61
Body mass index, kg/m^2	23.0 ± 3.9	22.0 ± 2.8	0.005
Body surface area, m^2	1.62 ± 0.18	1.57 ± 0.17	0.007
eGFR, mL/min/1.73 m^2	55.3 ± 29.2	63.0 ± 23.2	0.006
eGFR < 60, n (%)	90 (50.0%)	74 (43.3%)	0.21
Hemodyalisis, n (%)	21 (11.7%)	7 (4.1%)	0.01
Left ventricular ejection fraction, %	55.1 ± 13.7	59.2 ± 13.2	0.008
HbA1c, %	7.3 ± 1.1	5.9 ± 0.5	<0.001
Treatment of diabetes, n			
Diet only	53	–	
Insulin	51	–	
Sulfonylurea	58	–	
Alpha-glucosidase inhibitor	63	–	
Dipeptidylpeptidase-4 inhibitor	31	–	
Biganaide	17	–	
Glitazone	26	–	
Glinide	7	–	
Graft number, n	2.8 ± 1.1	2.4 ± 1.1	0.001

eGFR, estimated glomerular filtration rate.