

Evaluation of the incidence of aortic aneurysms in patients with and without diabetes in Poland in 2012 based on the database of the National Health Fund

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Abstract

Introduction: There are reports that diabetes mellitus reduces the risk of aortic aneurysms and many reports that diabetes mellitus reduces the risk of abdominal aortic aneurysms. In earlier years there were also studies that did not demonstrate any effects of diabetes on the rate of aortic aneurysms.

Material and methods: For the year 2012, between 1 January and 31 December, reports for services regarding treatment for aortic aneurysms were found. At the same time, the reports for services associated with diabetes with the main diagnosis of “diabetes mellitus” were found in National Health Fund databases for 2012 with the special determinants.

Results: In Poland in 2012 the mean incidence of aortic aneurysms in both sexes in the group of subjects with diabetes calculated per 100,000 subjects with diabetes was 167.78 ± 49.10 , and the mean incidence of aortic aneurysms in both sexes in the group of subjects without diabetes calculated per 100,000 of the general population after subtracting the number of subjects with diabetes was 27.72 ± 9.40 . The incidence of aortic aneurysms among subjects with diabetes was significantly higher ($p < 0.001$) than the incidence of aortic aneurysms among subjects without diabetes.

Conclusions: Aortic aneurysms were more frequently observed in the group of patients with diabetes than in those without diabetes. Aortic aneurysms were observed three times more frequently in men than in women. In Poland in 2012, 27.20% of patients diagnosed with aortic aneurysms also had diabetes.

Key words: diabetes mellitus, incidence, aortic aneurysms.

Introduction

In the USA in 2009 aortic aneurysms were observed in 10,597 cases and were the leading cause of death [1, 2]. According to the Centers for Disease Control and Prevention (CDCP), the risk factors for aortic aneu-

rysms include arterial hypertension, hypercholesterolaemia, and tobacco smoking [3, 4]. There are reports that diabetes mellitus reduces the risk of aortic aneurysms [5] and many reports that diabetes mellitus reduces the risk of abdominal aortic aneurysms [6, 7]. In earlier years there were also studies that did not demonstrate any effects of diabetes on the rate of aortic aneurysms [8, 9].

As there are discrepancies with regard to the effects of diabetes on the incidence of aortic aneurysms in the global literature and there are no reports regarding this subject in Poland, an attempt of a pilot study in this field was made. Based on the data from the National Health Fund from the period 1 January to 31 December 2012 in Poland, this paper presents the incidence of aortic aneurysms in this period based on main diagnoses taken from hospitalisation reports in the population of patients diagnosed with and without diabetes.

Material and methods

Health services in Poland are financed by the National Health Fund (NHF) based on the act [10] and regulations of the Minister of Health that result from this act [11, 12]. Health services in patients diagnosed with aortic aneurysm according to the following ICD-10 codes are performed as part of hospital treatment, namely under hospital contracts:

- 170.0 – dissecting aneurysm of any segment of the main aorta;
- 171.0 – dissecting aneurysm of the main aorta;
- 171.1 – aneurysm of the thoracic aorta, ruptured;
- 171.2 – aneurysm of the thoracic aorta, without rupture;
- 171.3 – aneurysm of the abdominal aorta, ruptured;
- 171.4 – aneurysm of the abdominal aorta, without rupture;
- 171.5 – aneurysm of the thoracoabdominal aorta, ruptured;
- 171.6 – aneurysm of the thoracoabdominal aorta, without rupture;
- 171.8 – aortic aneurysm of unspecified site, ruptured;
- 171.9 – aortic aneurysm of unspecified site, without rupture.

The regulations of the NHF president determine the organisation, financing and settlement of services [13, 14]. In 2008 homogeneous patient groups were introduced into the settlement system and since that time therapies have been funded in systems of special groups. Using Structured Query Language (SQL) in databases queries were performed in NHF databases in order to analyse such data presented in reports. The PESEL (personal ID no.) was considered to be a unique patient ID number [15].

For each year 2012, 2013 and 2014 between 1 January and 31 December reports for services regarding treatment for aortic aneurysms were found. At the same time, the reports for services associated with diabetes with the main diagnosis of “diabetes mellitus” were found in NHF databases for 2012 with the following determinants: E 10.X – insulin-dependent diabetes mellitus; E 11.X – non-insulin-dependent diabetes mellitus; E 12.X – malnutrition-related diabetes mellitus; E 13.X – other unspecified forms of diabetes mellitus; E 14.X – unspecified diabetes mellitus or in this period a patient had a prescription for any medicinal products from the group A 10.X (insulins), A 10 B.X (oral anti-diabetic agents) and specialist diagnostic tests. There were 2,227,453 such reports (PESEL numbers).

In 2012 a total of 13,794 patients were reported with the main diagnosis of aneurysm of the main aorta. The date of the first report for services mentioned above was determined arbitrarily for the year when an aortic aneurysm developed in a person with a given PESEL number.

Statistical analysis

Data were prepared with the statistical software of SAS and Statistica. Differences were considered to be significant at the significance level of 95% ($p < 0.05$).

Results

Statistical data regarding the general incidence:

1. In the period between 1 January and 31 December 2012 in total there were 2,227,453 patients with diabetes, 975,364 males and 1,252,089 females in the analysed Polish population.
2. The general population of Poland in 2012 was 38,533,784 persons, including 18,651,441 males and 19,882,343 females, according to GUS (Main Statistical Office).
3. In 2012 the general population without diabetes included 36,309,331 persons: 17,676,077 males and 18,633,254 females.

Table I presents numbers of patients with the main diagnosis of aortic aneurysm in patients diagnosed with diabetes and without diabetes in whom the diagnosis was made in 2012.

In 2012 in Poland, in total 13,794 persons were diagnosed with the first diagnosis of aortic aneurysm. The mean age of women diagnosed with diabetes was significantly higher than the mean age of men ($p < 0.01$). The mean age of women and men without diabetes did not differ significantly. According to a comparison of the mean age of men in the group of patients with diabetes and the mean age of men in the group of patients

Table I. Numbers of patients with the main diagnosis of aortic aneurysm in patients diagnosed with diabetes and without diabetes in whom the diagnosis was made in 2012

Patients	Men		Women		Men and women together Number
	Number	Mean age ± standard deviation	Number	Mean age ± standard deviation	
With diabetes	2906	69.63 ±9.32	846	70.65 ±10.49	3752
Without diabetes	7710	65.83 ±12.51	2332	66.05 ±14.20	10042

Table II. Percentages for all aortic aneurysms in 3 age groups in patients with and without diabetes in 2012

Age	Patients with diabetes (%)			Patients without diabetes (%)		
	Men	Women	Together	Men	Women	Together
Below the age of 44	0.71	1.86	1.04	5.63	8.10	6.34
Between 45 and 74	65.47	58.63	63.50	68.04	60.88	65.99
Above the age of 75	33.82	39.51	35.40	26.33	31.00	27.67

without diabetes, men in the group with diabetes were significantly older ($p < 0.001$). Similarly, women in the group of patients with diabetes were significantly older than women in the group without diabetes ($p < 0.001$). The percentage of patients with diabetes diagnosed with aortic aneurysm in 2012 was 27.20%, and the percentage of patients without diabetes diagnosed with aortic aneurysm was 72.80%.

Effect of age on incidence rate

Table II lists percentage amounts for all aortic aneurysms in individual age groups in patients with and without diabetes in 2012 depending on the sex, based on the NHF data.

The highest rates of new cases of aortic aneurysms were observed in both men and women with and without diabetes aged between 45 and 74 years and they were in the range of 58.63% to 68.04%. The lowest rates of new cases of aortic aneurysms were observed in the group below the age of 40 years inclusive. These rates did not differ significantly between men and women, and the total percent was 1.04%: 0.71% in men and 1.86% in women. In both sexes without diabetes below the age of 44 years the incidence was 6.34%: 5.63% in men and 8.10% in women. The incidence of aortic aneurysms in subjects in this age group was many times higher in persons without diabetes compared to the incidence among diabetic patients.

Table III presents a comparison of percentage rates of men and women in 2012 with regard to subjects with and without diabetes according to the database of the NHF.

In male subjects with diabetes the percentage rate was 77.45%, and in men without diabetes the rate was 76.78%. On the other hand, the percent-

Table III. Percentages of men and women in 2012 in Poland with regard to subjects with and without diabetes

Patients	Men (%)	Women (%)
With diabetes	77.45	22.55
Without diabetes	76.78	23.22

age rate of women among subjects with diabetes was 22.55%, and in women without diabetes it was 23.22%.

In 2012 the incidence of aortic aneurysms among both sexes was 37.72/100,000 of the general population, and in men it was 56.92/100,000 of the general population, whereas in women it was 15.98/100,000 of the general population.

Table IV compares the incidence of aortic aneurysms in subjects with diabetes calculated per 100,000 subjects with diabetes and without diabetes calculated per 100,000 of the general population after subtracting the number of patients with diabetes reported in individual branches of the Voivodship National Health Fund in Poland in 2012.

In Poland in 2012 the mean incidence of aortic aneurysms in both sexes in the group of subjects with diabetes calculated per 100,000 subjects with diabetes was 167.78 ± 49.10 , and the mean incidence of aortic aneurysms in both sexes in the group of subjects without diabetes calculated per 100,000 of the general population after subtracting the number of subjects with diabetes was 27.72 ± 9.40 .

The incidence of aortic aneurysms among subjects with diabetes was significantly higher ($p < 0.001$) than the incidence of aortic aneurysms among subjects without diabetes.

Moreover, in the group of patients with diabetes the incidence of aortic aneurysms in 2012 in

Table IV. Comparison of the incidence of aortic aneurysms in subjects with diabetes calculated per 100,000 subjects with diabetes and without diabetes calculated per 100,000 of the general population after subtracting the number of patients with diabetes reported in individual branches of the Voivodship National Health Fund in Poland in 2012

Province	Patients with aortic aneurysms and diabetes mellitus per 100,000 patients with diabetes	Patients with aortic aneurysms and without diabetes mellitus per 100,000 patients without diabetes
Lower Silesia	185.09	30.19
Kujawy-Pomerania	211.77	29.84
Lublin	141.04	51.55
Lubuskie	71.61	12.31
Lodz	197.81	23.25
Małopolska	176.91	24.38
Mazovia	225.29	34.55
Opole	86.00	15.21
Podkarpacie	189.32	22.68
Podlasie	138.77	28.84
Pomerania	135.93	19.59
Silesia	184.67	27.31
Świętokrzyskie	135.29	17.56
Warmia-Masuria	205.08	32.99
Wielkopolska	146.42	24.60
West Pomerania	253.49	30.60
Poland (average ± standard deviation)	167.78 ±49.10	27.22 ±9.40

various voivodships ranged between 71.61 and 253.49 calculated per 100,000 of patients with diabetes. The analysis presents the place where hospitalisation was reported and not the place of residence of patients.

Discussion

This analysis is unique and the first in Poland. It compares the incidence of aortic aneurysms in people without diabetes and with diabetes.

In Poland in 2012 we estimated the number of patients with diabetes on the basis of NHF data. This allowed us to calculate the incidence of aortic aneurysms in 100,000 patients with diabetes and to compare this figure with the occurrence of aortic aneurysms in those with no known diabetes in the 100,000 population of the general population after subtracting the number of patients with diabetes.

Controversies regarding the incidence of all types of aortic aneurysms may be a result of various methods to calculate the rate per 100,000 of the general population.

Lilienfeld *et al.* present the incidence of all types of aortic aneurysms. In men it was 40.6–

49.3/100,000 inhabitants. In women it was 6.8–12.3/100,000 inhabitants [16]. In 2012 in Poland the mean incidence of aortic aneurysms in subjects with diabetes was lower than the mean incidence of aortic aneurysms in subjects without diabetes in both sexes, men and women separately calculated per 100,000 of the general population.

However, if the second method of calculation is used, namely the number of new cases of aortic aneurysms in a given year in subjects with diabetes per 100,000 of subjects with diabetes and if the number of patients with aortic aneurysms in subjects without diabetes in a given year is calculated per 100,000 of the general population after subtracting the number of subjects with diabetes, the results obtained will be different.

When the incidence rates were calculated separately for all branches of the National Health Fund in Poland the incidence of aortic aneurysms in 2012 in subjects with diabetes of both sexes was 167.78 ±49.10 on average per 100,000 of patients with diabetes, whereas the incidence of aortic aneurysms in 2012 in subjects without diabetes of both sexes was 27.22 ±9.40 per 100,000 of the

general population after subtracting the number of subjects diagnosed with diabetes.

In 2012 subjects with diabetes accounted for 27.2% of patients diagnosed with aneurysm of the main aorta. On the other hand, subjects without diabetes diagnosed with aortic aneurysms accounted for 72.8%, namely 1/3 of the number were patients with diabetes.

It has to be added that in 2012 in Poland the percentage of patients with diabetes in the whole national population was 5.78% [17]. Namely the subgroup of patients with diabetes was 1/17 of the general population in 2012 in Poland. In our opinion the second method of calculation presents the incidence rates in the study populations more precisely compared to calculations per 100,000 of the general population. However, the problem is still open and further studies are required. Many reports regarding abdominal aorta aneurysms indicate that the incidence rate in subjects with diabetes is lower than in those without diabetes [18–21].

In the Spanish study diabetic patients accounted for 16.7% of all patients with abdominal aorta aneurysms [19]. Within the follow-up period of 10 years in Spain there was an increase of 33% in the incidence of abdominal aorta aneurysms in the group of patients with diabetes, and in patients without diabetes this increase was 11%.

Diabetic men were older by more than 4 years compared to our patients and accounted for 91.9% of all diabetic patients [19]. In our study 3/4 of patients were men. In all reports aortic aneurysms are 2–6 times more frequently observed in men compared to women [6, 22, 23].

In our study the age of subjects with diabetes and aortic aneurysms was higher than the age of subjects with aortic aneurysms but without diabetes.

In our studies aortic aneurysms were observed the most frequently in the age group between 45 and 74 years, both in men and women, and in subjects with and without diabetes.

Aortic aneurysms were the least common in the age group from 44 years inclusive, in subjects with and without diabetes. In the age group below 44 years in subjects without diabetes aortic aneurysms developed a few times more frequently compared to their incidence in the same age group of diabetic patients.

Boll *et al.* stated that in men abdominal aorta aneurysms were observed at the age of 60–80 years [24]. Ashton *et al.* stated that abdominal aorta aneurysms were most frequently observed at the age of 65–74 years [25]. Bickerstaff *et al.* reported that the peak incidence of thoracic aorta aneurysms in men is at the age of 70 years, and in women the peak incidence of thoracic aorta aneurysms is at the age of approximately 80 years [26].

Our studies were limited by the fact that based on the data obtained it was not possible to determine precisely the type of diabetes, its duration, metabolic compensation of diabetes and complications. It was not possible to determine treatment reducing the LDL cholesterol levels precisely, and it was not possible to assess antihypertensive treatment.

In Poland there is no register of patients with diabetes. Therefore this paper attempts to evaluate the incidence of aortic aneurysms in subjects with and without diabetes.

In conclusion, the incidence of aortic aneurysms in Poland in 2012 calculated per 100,000 of the general population was as follows: 56.92 in men, 15.98 in women. Aortic aneurysms were more frequently observed in the group of patients with diabetes compared to those without diabetes. Aortic aneurysms were observed three times more frequently in men than in women. Aortic aneurysms were observed more frequently in men and women at the age between 45 and 74 years. In Poland in 2012, 27.20% of patients diagnosed with aortic aneurysms also had diabetes.

Conflict of interest

The authors declare no conflict of interest.

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