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Myocardial Infarction Correlated with the Age and Gender of the Patient in Autopsy Examinations

Zawał mięśnia sercowego w badaniu autopsyjnym a wiek i płeć chorego

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Abstract

Background. Infarction can occur at practically any age, but the risk increases significantly with age; this is mainly associated with the progressive development of atherosclerosis. In addition, males are significantly more predisposed to infarction than pre-menopausal women are, due to the protective effects of estrogen in the reproductive age period. There have been many diagnostic tests showing significant narrowing of coronary arteries and indicating the location of myocardial infarction. In terms of pathomorphology, autopsy examinations allow confirmation of the exact location and evaluation of a fatal heart attack.

Objectives. The aim of this study was to define the location of myocardial infarction in pathomorphological terms, and to investigate the correlation with age and gender.

Material and Methods. The main inclusion criterion used in this study was the macroscopically and microscopically diagnosis of myocardial infarction in autopsy material. The number of myocardial infarctions in the group analyzed was established using post-mortem records. Data on the specific localization of the myocardial infarction was noted as well. Using the available clinical data, the patients were divided into groups by age at the time of death (over or under 65 years). In each group, men and women were studied separately.

Results. The data concerning males clearly revealed a statistically significant larger percentage of myocardial infarction in the anterior wall than in the results from women. Data concerning patients 65 years old or under revealed a statistically significant larger percentage of myocardial infarction in the anterior wall compared with the results from patients over 65 years.

Conclusions. Autopsy examination revealed differences in the location of myocardial infarction depending on the age and sex of patients (*Adv Clin Exp Med* 2011, 20, 4, 441–445).

Key words: myocardial infarction, autopsy examination, location of myocardial infarction.

Streszczenie

Wprowadzenie. Zawał mięśnia sercowego może wystąpić w każdym wieku, ale prawdopodobieństwo jego wystąpienia zwiększa się wraz z upływem lat, co jest przede wszystkim związane ze stopniowym rozwojem miażdżycy. Dodatkowo mężczyźni są w znacznym stopniu bardziej predysponowani niż kobiety, które w wieku rozrodczym są pod ochronnym działaniem estrogenów. W wielu badaniach diagnostycznych wykazano istotne zwężenia w naczyniach wieńcowych oraz przedstawiono umiejscowienie zawałów serca. W aspekcie patomorfologicznym istnieje możliwość dokładnego potwierdzenia oraz oceny umiejscowienia śmiertelnego zawału serca na podstawie badania autopsyjnego.

Cel pracy. Ocena umiejscowienia zawału mięśnia sercowego w aspekcie patomorfologicznym oraz jego korelacja z wiekiem i płcią pacjenta.

Materiał i metody. Jako główne kryterium kwalifikujące przypadki do badań przyjęto rozpoznanie makroskopowe oraz mikroskopowe zawału serca w badaniu autopsyjnym. W analizowanej grupie na podstawie protokołów sekcyjnych uzyskano szczegółowe dane o liczbie zawałów, które dotyczyły poszczególnych ścian mięśnia sercowego. Opierając się na uzyskanych informacjach, pacjentów podzielono na grupy ze względu na wiek w chwili śmierci, tj. przed i po 65. r.ż. W każdej z grup osobno rozpatrywano kobiety i mężczyzn.

Wyniki. Uzyskane wyniki dotyczące mężczyzn jednoznacznie wykazały istotny statystycznie większy udział procentowy zawału ściany przedniej serca w porównaniu z wynikami uzyskanymi u kobiet. Dane dotyczące osób poniżej lub w wieku 65 lat wykazały istotny statystycznie większy udział procentowy zawału ściany przedniej mięśnia sercowego w porównaniu z wynikami uzyskanymi w grupie osób powyżej 65 lat.

Wnioski. Badanie autopsyjne wykazało różnicę w umiejscowieniu zawałów mięśnia sercowego serca zarówno w zależności od wieku, jak i płci pacjentów (*Adv Clin Exp Med* 2011, 20, 4, 441–445).

Słowa kluczowe: zawał mięśnia sercowego, badanie autopsyjne, umiejscowienie zawału mięśnia sercowego.

Myocardial infarction is focal necrosis of the heart muscle caused by hypoxia. In Poland, coronary heart disease is believed to be responsible for about 40% of the deaths among middle-aged males, and (after malignant tumors) is the second most frequent cause of premature death among women [1, 2]. Infarction can occur practically at any age, but the risk increases significantly with age; this is mainly associated with the progressive development of atherosclerosis. Only about 10% of all heart attacks occur in people under 40 years old, and up to 45% of them are in people under 65. Males are significantly more predisposed to infarction than pre-menopausal women are, due to the protective effects of estrogen in the reproductive age period.

Myocardial infarction (MI) most often occurs in connection with coronary atherosclerosis. Changes in atherosclerotic plaque are the most common starting point for thrombus formation and occlusion of the artery. This process leads to myocardial infarction of the area supplied by the occluded vessel. It is known that so-called right coronary dominance of blood flow is more frequent. However in 40–50% of MI patients narrowing is found in the left anterior descending coronary artery (LAD), which supplies the anterior wall of the left ventricle, the apex of the heart and the front two thirds of the interventricular septum. The circumflex branch of the left coronary artery (LCX), which has been reported to be narrowed in 15–20% of MI cases, covers the lateral wall of the left ventricle, except for the apex of the heart. The right coronary artery (RCA), in which narrowing occurs in 30–40% of heart attacks, covers the posteroinferior wall of the left ventricle, the posterior part of the interventricular septum and part of the posterior wall of the right ventricle in 20% of MI cases.

Myocyte necrosis begins after 20–30 minutes of artery occlusion, and myocardial infarction takes place within 3 to 6 hours. Macroscopic changes may be difficult to recognize in an autopsy examination if the patient died less than 8 to 12 hours after the MI. In the first 4 to 12 hours after a heart attack it is only possible to identify a small zone of myocardial whitening (hypoxia). In the next period, from 12 to 24 hours, the muscle exhibits a distinct pallor with a yellowish center. After

24 hours, the changes take the form of a tan lesion with a peripheral zone of congestion. However, in a microscopic examination, the first changes can already be seen in the first two hours following a heart attack. The evolution of the changes includes the presence of wavy muscle fibers and early necrotic lesions, appearing after 6–8 hours. After this period, fully developed coagulative necrosis is clearly visible. Next there is a process of clearance of the dead muscle fibers, which reaches maximum activity within the following 4–7 days. Within 3 to 6 weeks after this a scar forms. At the site of a healed myocardial infarction, a thickened ventricular wall, with hard and gray tissue, is usually found. This corresponds to the presence of a scar.

The aim of this study was to define the location of myocardial infarction in pathomorphological terms, and to investigate the correlation with age and gender.

Material and Methods

At the Department of Pathology of the 10th Military Hospital in Bydgoszcz, Poland, 214 autopsy examinations were performed between January 2006 and February 2010. The main inclusion criterion used in this study was a macroscopic and microscopic diagnosis of myocardial infarction in the autopsy material. The authors analyzed the post-mortem records of 72 cases from 2006, 44 from 2007, 51 from 2008, 47 from 2009 and 11 from 2010. All cases in which the autopsy took place over 72 hours after death were rejected.

The resulting study group included 31 men and 24 women. In 19 cases myocardial infarction was diagnosed clinically; in 36 the cause of death was unclear. In the analyzed group, based on post-mortem records, the number of myocardial infarctions and data on the specific localization of myocardial infarction were noted. Infarcts were detected macroscopically during autopsy examination and were also confirmed by microscopic examination based on routine hematoxylin and eosin (H+E) staining. Taking into consideration only pathomorphological data, there were patients with infarction of the interventricular septum, the

anterior wall of the left ventricle, the posterior wall of the left ventricle, the inferior wall of the left ventricle, the apex of the heart and the right ventricle.

Based on the available clinical data, the patients were divided into groups by age at the time of death, i.e. above or below 65. In each group, men and women were studied separately. SPSS 14.0 software was used. For the statistical analysis of the test results, including the nonparametric Mann-Whitney test at a fixed level of significance of 0.05.

Results

In the analyzed group of deceased patients ($n = 55$) there were 24 women (average age 73 years). Among the female patients myocardial infarction was found in the interventricular septum in 14 cases, in the anterior wall in 4 cases, in the posterior wall in 12 cases, in the inferior wall in one case and in the apex of the heart in 2 cases.

The mean age of the 31 men in the study group was 65 years, which was significantly lower than the average age of the women. Among the males myocardial infarction was found in the interventricular septum in 19 cases, in the anterior wall in 14 cases, in the posterior wall in 12 cases and in the apex of the heart in 2 cases (Figures 1 and 2). The data obtained for the males clearly revealed a statistically significant larger percentage of myocardial infarction in the anterior wall compared with the women (Table 1). Other data regarding the location of myocardial infarction did not differ significantly between women and men.

The analyzed group was then divided according to age, forming two subgroups. The first consisted of 19 patients aged 65 years or less, and the second consisted of 36 patients over 65. In the younger group, infarction was found in the interventricular septum in 12 cases, in the anterior wall in 10 cases, in the posterior wall in 8 cases and in the cardiac apex in 2 cases. The older group included 21 cases of infarction in the interventricular sep-

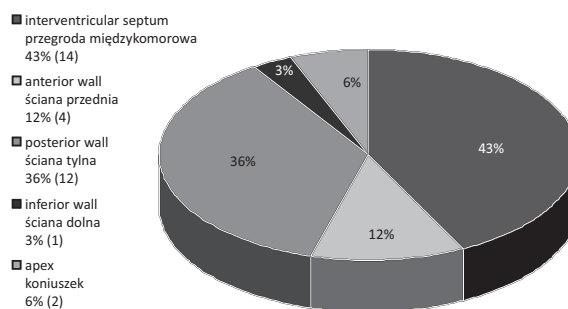


Fig. 1. Distribution of locations of acute myocardial infarction in various walls of the heart in women. Data expressed as percentages; the number of cases given in brackets

Ryc. 1. Procentowe zajęcie poszczególnych ścian serca u kobiet z zawałem serca. W nawiasie podano liczbę przypadków

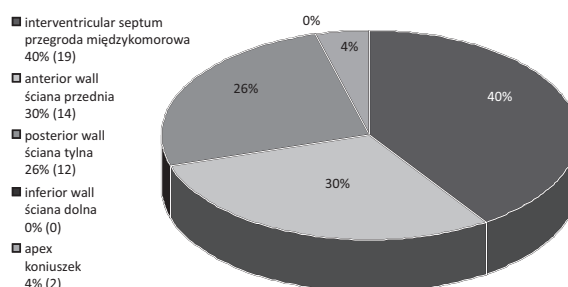


Fig. 2. Distribution of locations of acute myocardial infarction in various walls of the heart in men. Data expressed as percentages; the number of cases given in brackets

Ryc. 2. Procentowe zajęcie poszczególnych ścian serca u mężczyzn z zawałem serca. W nawiasie podano liczbę przypadków

tum, 8 in the anterior wall, 16 in the posterior wall, 1 in the inferior wall and 2 in the apex of the heart (Fig 3 and 4). The obtained data for patients aged 65 or less revealed a statistically significant larger percentage of myocardial infarction in the anterior wall compared with the results for patients over 65 years (Table 2).

Table 1. Evaluation of the statistical significance of the location of myocardial infarction in men and women.

Tabela 1. Ocena istotności statystycznej umiejscowienia zawału serca u kobiet i mężczyzn

	Myocardial infarction of the interventricular septum (Zawał przegrody międzykomorowej)	Myocardial infarction of the anterior wall (Zawał ściany przedniej)	Myocardial infarction of the posterior wall (Zawał ściany tylnej)	Myocardial infarction of the inferior wall (Zawał ściany dolnej)	Myocardial infarction of the apex (Zawał koniuszka)
Significance (Istotność)	NS	0.019	NS	NS	NS

NS – not significant.

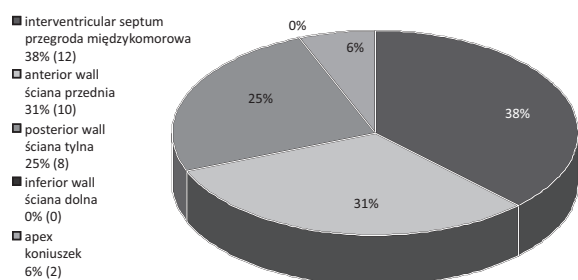


Fig. 3. Distribution of locations of acute myocardial infarction in various walls of the heart in patients aged 65 or less. Data expressed as percentages; the number of cases given in brackets

Ryc. 3. Procentowe zajęcie poszczególnych ścian serca u osób z zawałem serca w wieku < 65 lat. W nawiasie podano liczbę przypadków

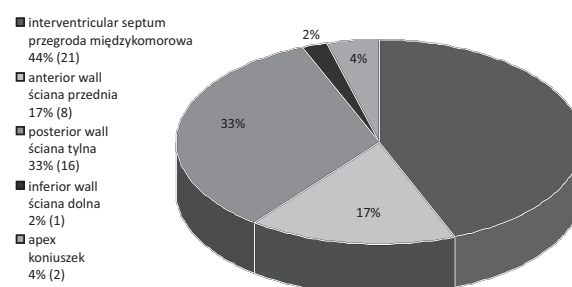


Fig. 4. Distribution of locations of acute myocardial infarction in various walls of the heart in patients over age 65. Data expressed as percentages; the number of cases given in brackets

Ryc. 4. Procentowe zajęcie poszczególnych ścian serca u osób z zawałem serca w wieku > 65 lat. W nawiasie podano liczbę przypadków

Table 2. Evaluation of the statistical significance of the location of myocardial infarction in patients aged 65 or less and in patients over 65

Tabela 2. Ocena istotności statystycznej umiejscowienia zawału serca u osób < 65 lat oraz > 65 lat

	Myocardial infarction of the interventricular septum (Zawał przegrody międzykomorowej)	Myocardial infarction of the anterior wall (Zawał ściany przedniej)	Myocardial infarction of the posterior wall (Zawał ściany tylnej)	Myocardial infarction of the inferior wall (Zawał ściany dolnej)	Myocardial infarction of the apex (Zawał koniuszka)
Significance (Istotność)	NS	0.05	NS	NS	NS

NS – not significant.

Discussion

Progress in diagnostics and treatments in developed countries has resulted in increased life expectancy for men and women and an increase in the number of elderly people. One consequence of this epidemiological data is an increase in the number of cases of diseases typical of elderly people, including heart disease. Increasing age is also associated with the severity of systemic atherosclerosis and narrowing of the coronary arteries, which leads to flow limitation and myocardial infarction. In this study on a group of 55 cases, a significantly higher proportion of heart attacks occurred in patients over 65 years old. A correlation was also found between age and the topographic characteristics of heart disease. A higher percentage of the anterior wall infarcts (31%) was noted in the patients under 65 years old, which may correlate with more frequent changes in the anterior descending branch of the left coronary artery. Patients over 65 showed a greater percentage of myocardial infarction in the posterior wall (33%), which may indicate more frequent participation of the right coronary artery [4, 5]. These results do not confirm the findings reported by Dąbek et al [3]. Those authors stud-

ied acute coronary syndromes in patients over 80 years old who underwent coronary angiography to detect critical stenosis of the coronary arteries; and the most widened vessels found were branches of the anterior descending coronary artery (38.8% of the dilated blood vessels), followed by the right coronary artery (36.1%) and the circumflex branch (16.6%). The other vessels are the trunk of the left coronary artery – 8.3% of the dilated blood vessels – and the marginal and posterior branch of the descending artery – 2.1%. Comparing the results of clinical results of the present study and those published by Dąbek et al, it can be suggested that at older ages, fatal myocardial infarction is more common in the right coronary artery.

When the study group was divided into subgroups according to gender, a difference of 8 years in the average age of a heart attack was apparent. Cardiovascular disease among women develops 10 to 15 years later than in men due to the protective effects of estrogen. The Framingham Study showed that women under 50 years old suffer from and/or die of cardiovascular diseases 6 times less frequently than men [6]. In postmenopausal women, the risk of developing coronary heart disease increases significantly. It is believed that this

is due to the inhibition of the synthesis and secretion of estrogen, which has a protective effect on the cardiovascular system, primarily on lipid metabolism [7, 8]. Estrogen also affects coagulation and fibrinolysis, has beneficial antioxidant effects and regulates the tension of vascular walls [8, 9]. Processes that are known to occur in the post-

menopausal period, in combination with research results showing a lower percentage of anterior wall involvement in women than in men (12% and 30% respectively), may suggest more intensive development of atherosclerotic plaque in women's right coronary artery. The characteristics of this process may be related to estrogen imbalances.

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