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Arterial hypertension as a risk factor for cardiovascular diseases in the group of patients referred for coronary catheterization after the age of 65

Nadciśnienie tętnicze jako jeden z czynników ryzyka chorób sercowo-naczyniowych w grupie pacjentów kierowanych na koronarografię po 65. roku życia

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Summary

Introduction. Arterial hypertension morbidity rate and the risk of related diseases and complications increases with age.

Aim. The aim of the work was to evaluate the frequency of occurrence of arterial hypertension in patients referred for coronary catheterization, with consideration of patients after the age of 65, and evaluation of occurrence of risk factors for cardiovascular diseases in the population under analysis.

Material and methods. A group of 423 patients with coronary thrombosis, referred for coronarography, was subject to a retrospective survey. The patients were divided into two groups: below and over 65 years old.

Results. On the basis of medical history, arterial hypertension was found in 83.45% of the patients. In the group > 65 y.o., 58.7% had arterial hypertension, and in the group < 65 y.o., the rate was 41.3%. In both age groups, arterial hypertension affected males significantly ($p < 0.001$) more often. Average values of systolic pressure at admission to the clinic were significantly higher in patients > 65 y.o. (141.95 ± 24.02 mmHg vs 136.32 ± 19.430 mmHg; $p < 0.026$), also SBP during the stay in hospital was significantly higher ($p < 0.001$) in the group of older patients. Average diastolic pressure at admission and during hospitalization was comparable in both groups. Patients over 65 were significantly more often overweight (21.9% vs 12.1%; $p < 0.013$) whereas obesity occurred in a bigger number of younger people (86.6% vs 77.5%). The average value of eGRF (estimated in accordance with the MDRD formula) was significantly lower ($p < 0.001$) in the group of patients > 65 y.o. Patients < 65 y.o. had significantly higher ($p < 0.013$) total cholesterol concentration and higher triglycerides concentration ($p < 0.001$). Patients over 65 significantly more often ($p < 0.001$) took diuretics.

Conclusions. Patients with arterial hypertension over 65 y.o. constitute a high percentage of those suffering from coronary thrombosis referred for coronarography. It is the population of patients charged with additional risk factors (overweight, lower eGRF and higher values of systolic pressure).

Key words: arterial hypertension, old age, risk factors

Streszczenie

Wstęp. Wraz z wiekiem zapadalność na nadciśnienie tętnicze oraz ryzyko związanych z tym chorób i powikłań wzrasta. Celem pracy była ocena częstotliwości występowania nadciśnienia tętniczego u pacjentów kierowanych na koronarografię z uwzględnieniem chorych po 65. roku życia oraz ocena występowania w badanej populacji czynników ryzyka chorób sercowo-naczyniowych.

Materiał i metody. Badania retrospektywne przeprowadzono w grupie 423 chorych z chorobą wieńcową, skierowanych na koronarografię. Pacjentów podzielono na dwie grupy: poniżej i powyżej 65. roku życia.

Wyniki. Nadciśnienie tętnicze na podstawie wywiadu stwierdzono u 83,45% chorych. W grupie > 65. roku życia nadciśnienie tętnicze miało 58,7%, zaś w grupie < 65. roku życia – 41,3%. W obu przedziałach wiekowych istotnie ($p < 0,001$) częściej nadciśnienie tętnicze dotyczyło mężczyzn. Średnie wartości ciśnienia skurczowego przy przyjęciu do kliniki były istotnie

wyższe u pacjentów > 65. roku życia ($136,32 \pm 19,43$ mmHg vs $141,95 \pm 24,02$ mmHg; $p < 0,026$), również SBP w trakcie pobytu w klinice było istotnie wyższe ($p < 0,001$) w grupie pacjentów starszych. Średnie ciśnienie rozkurczowe przy przyjęciu jak i w trakcie pobytu było porównywalne w obu grupach. Pacjenci po 65. roku życia istotnie częściej mieli nadwagę (21,9% vs 12,1%; $p < 0,013$); natomiast otyłość występowała w większym odsetku u osób młodszych (86,6% vs 77,5%). Średnia wielkość eGRF (oszacowana według wzoru MDRD) była istotnie niższa ($p < 0,001$) w grupie pacjentów > 65. roku życia. Pacjenci < 65. roku życia mieli istotnie ($p < 0,013$) wyższe stężenie cholesterolu całkowitego oraz wyższe stężenie triglicerydów ($p < 0,001$). Pacjenci po 65. roku życia istotnie częściej ($p < 0,001$) przyjmowali leki moczopędne.

Wnioski. Pacjenci z nadciśnieniem tętniczym po 65. roku życia stanowią duży odsetek wśród chorych z chorobą wieńcową kierowanych na koronarografię. Jest to populacja pacjentów obciążona dodatkowymi czynnikami ryzyka (nadwaga, niższe przesączanie kłębuszkowe eGRF oraz wyższe wartości ciśnienia skurczowego).

Słowa kluczowe: nadciśnienie tętnicze, wiek podeszły, czynniki ryzyka

INTRODUCTION

As is shown by demographic data, in Western populations we can observe a constant increase of percentage of people over 60 y.o. and a constant increase of the number of people over 80 y.o. (1). In Poland, the percentage of old age society is growing as well. Longer life is a result of progress in medicine over the last 20 years and general improvement of life conditions. Unfortunately, along with the lengthening of life expectancy, the number of chronically ill people who require constant care is also rising. So the question appears of how we can lengthen our life and at the same time prevent the process of impairment of the ability to function on our own, which is related to age.

The population of elderly people is characterised by multiple morbidities. One of the most frequently occurring chronic diseases, with a very high significance in that population, is arterial hypertension. Arterial hypertension in the population of elderly people occurs in 60-70% (2, 3). In this group, 50-60% of patients have isolated systolic hypertension, which triggers a higher risk of death resulting from coronary thrombosis or cerebral stroke (4). Multiple morbidities also result in polypharmacy, which means a patient simultaneously uses a big number of medicines every day.

Treating arterial hypertension brings great health benefits connected with lowering the risk of such cardiovascular complications as coronary thrombosis and heart attack, left-ventricular hypertrophy and cardiac insufficiency, cerebral stroke or nephropathy. Elderly people are a specific group of patients, often difficult to treat. On the one hand, threshold values for starting hypotension pharmacotherapy and target values of hypertension reduction do not differ from the rest of the society, but on the other hand, the way of conducting pharmacotherapy should be individualized and strictly controlled. Along with the organism growing old, certain changes occur in the functioning of cardio-vascular system and other systems. Vessels get more rigid and baroreceptors become dysfunctional, which promotes postprandial and orthostatic blood pressure drops (5). Liver function is also impaired. That lowers metabolism of drugs and increases the risk of their accumulation in the organism. In elderly people we can observe a loss of renal blood flow and glomerular filtration rate, which causes reduced expelling of drugs and results in higher occurrence of unfavourable interactions

and adverse drug reactions (6). With advancing age, apart from arterial hypertension, the occurrence of risk factors, such as insulin resistance and hyperinsulinemia, diabetes mellitus, overweight and obesity, hyperlipidemia, left-ventricular hypertrophy, thickening of carotid artery wall and increased concentration of C-reactive protein also increases (7-9). All those differences must be taken into consideration when choosing pharmacotherapy. Another important problem is to establish appropriate cooperation with the patient. Memory disorders, lack of support from the family, costs of treatment and mood disorders make it considerably more difficult (10).

AIM

The aim of the work was to evaluate the occurrence of arterial hypertension in patients referred for coronary catheterization after the age of 65 in comparison to patients below that age, with consideration of other risk factors for cardiovascular diseases.

MATERIAL AND METHODS

423 successive patients hospitalized in the Invasive Cardiology Clinic within the period of 3 months were covered with a retrospective study. The patients with arterial hypertension were divided into two groups: below and over 65 years old.

Data from medical documentation (case histories), values of blood pressure at admission and during hospitalization and the results of laboratory tests were analyzed. The received results were subject to statistical analysis, in which the arithmetic mean and standard deviation were calculated for the measurable features, and quantitative-percentage distribution was determined for qualitative features.

For the features conforming to normal distribution, evaluated with the Shapiro-Wilk test, the t-Student test and the Mann-Whitney test were applied respectively for comparison between the analysed groups. Comparison of qualitative features between the groups was done with the χ^2 test. For the calculations, the significance level $p < 0.05$ was assumed as statistically significant.

RESULTS

Arterial hypertension

In the research group, ($n = 423$), 353 (83.65%) patients had arterial hypertension; there were 124 (35.1%)

women and 229 (64.9%) men with arterial hypertension. The number of patients with arterial hypertension below the age of 65 was 146 (41.3%), and over 65, 207 (58.7%). In both age groups, arterial hypertension significantly more often ($p < 0.001$) occurred in men.

As regards the mean values of blood pressure, definitely higher values of systolic blood pressure at admission ($p < 0.026$) and during the stay in hospital ($p < 0.001$) were observed in the group of patients over 65 y.o. than in patients below 65 y.o. (tab. 1).

Risk factors

Characteristically higher mean values of BMI ($p < 0.001$) were also observed in the group < 65 y.o. Older patients were significantly more often overweight (21.9% vs 12.1%; $p < 0.013$); and obesity occurred in a bigger number of younger people (86.6% vs 77.5%).

The occurrence of diabetes mellitus in the group < 65 y.o. was 24.7%, and in the group > 65 y.o., 18.8%.

As for average values of lipid metabolism, significantly higher total cholesterol concentration ($p < 0.013$) and triglycerides ($p < 0.001$) were observed in the group of younger patients in comparison to the older ones (tab. 1).

Chronic kidney disease significantly more often occurred in the group of patients over 65 y.o. (16.4% vs 3.4%; $p < 0.001$).

In the group of patients over 65 y.o. we noticed characteristically lower levels of hematocrit ($p < 0.003$), haemoglobin ($p < 0.001$), erythrocytes ($p < 0.001$) and blood platelets ($p < 0.026$).

Younger patients significantly more often smoked cigarettes as compared to the older patients (47.9% vs 18.1%; $p < 0.003$). 60.3% of patients < 65 y.o. and 41.9% of patients > 65 y.o. had positive cardiological history.

Ischaemic heart disease

The proportion of patients with stable ischaemic heart disease in both groups was comparable and amounted to approx. 70%. Heart attacks significantly more often occurred in patients > 65 y.o. (48.1% vs 35.6%, $p < 0.013$). About 14% of patients, both < 65 y.o. and > 65 y.o. suffered from unstable ischaemic heart disease. Patients over 65 y.o. significantly more often had had PCI done before (63.3% vs 53.4%; $p < 0.004$). No relation was found between age and the frequency of previous coronary artery bypass surgery (CABG) occurrence. The clinical characteristics is presented in table 1.

Pharmacotherapy

The use of ACE inhibitors, ARBs, statins and beta-adrenergic antagonists was comparable in both age groups. Significantly more frequent use of calcium channel blockers ($p < 0.042$) and ASA ($p < 0.001$) was observed in the group of younger patients in relation to the older ones. Diuretics were applied significantly more often ($p < 0.001$) in the group of patients > 65 y.o.

DISCUSSION

Arterial hypertension in elderly people is the main risk factor predisposing patients to the development of coronary thrombosis and congestive heart failure and is a risk factor for cardiovascular events (cerebral stroke, sudden death) (11, 12). With age, the dependence between absolute risk of cardiovascular diseases and the stage of arterial hypertension increased. For example, in the group of people 80 years old or older, within 6 years of observation, serious cardiovascular events occurred in 9.5% of persons with normal blood pressure, 19.8% of those with prehypertension, 20.3% of patients with stage 1 hypertension and 24.7% of people with stage 2 hypertension and pharmacologically treated hypertension (13).

The conducted retrospective analysis showed that approx. 59% of patients referred for coronary catheterization were people over 65 y.o. with arterial hypertension. Irrespective of age, high blood pressure more often affected males. As for females, the rate of women with hypertension increased with age. Similar results were obtained in the WOBASZ study, which showed that women in younger age groups much more rarely suffer from hypertension. It changes at the age of 55-64, as in that age group about 50% men and women have hypertension. But in the older group (65-74 years old), slightly higher occurrence of hypertension in women than in men was shown (58% vs 56%) (4). Factors which cause a rise in blood pressure after menopause include higher bodily weight, which may lead to hyperinsulinaemia. Deficiency of oestrogens results in lower excretion of nitric oxide, and thus in alteration in the walls of vessels and increase in resistance in cardiovascular system. Changes occurring as a result of menopause are difficult to differentiate from vascular changes caused by growing old (14).

An elderly patient with clinically significant coronary thrombosis or kidney disease is in the group of very high risk at higher blood pressure values than a younger patient with one or two risk factors (15). Therefore, proper treatment of arterial hypertension in the population of elderly people is vital. It has been proved that in the population of elderly patients, hypotensive therapy brings great health benefits connected with lowering the risk of such cardiovascular complications as coronary thrombosis and heart attack, left-ventricular hypertrophy and cardiac insufficiency, cerebral stroke or nephropathy (16). Not long ago, there were doubts whether arterial hypertension should be pharmacologically treated at all in people of old age. Those doubts were dissipated by the HYVET study, published in 2008. The results of HYVET study confirm that people over the age of 80 can also benefit from hypotensive therapy, regarding morbidity and prolonging life alike (17).

Following the recommendations of the JNC report (18), approx. 47% of patients over 65 received diuretics; the use of ACE-I was comparable in both age groups

Table 1. Clinical characteristics of patients.

| Parameter | Age | Average \pm SD | Minimum | Maximum | Value of p |
|---|-----------|--------------------|---------|---------|------------|
| SBP at admission (mmHg) | < 65 y.o. | 136.32 \pm 19.43 | 103 | 200 | 0.026 |
| | > 65 y.o. | 141.95 \pm 24.02 | 90 | 230 | |
| DBP at admission (mmHg) | < 65 y.o. | 83.02 \pm 12.82 | 39 | 133 | ns |
| | > 65 y.o. | 81.17 \pm 12.62 | 55 | 130 | |
| SBP during hospitalization (mmHg) | < 65 y.o. | 122.69 \pm 15.19 | 91 | 162 | 0.001 |
| | > 65 y.o. | 130.48 \pm 17.56 | 70 | 182 | |
| Ht (%) | < 65 y.o. | 41.480 \pm 4.08 | 27.2 | 50.0 | 0.003 |
| | > 65 y.o. | 39.937 \pm 5.21 | 26.0 | 69.9 | |
| Hb (g/dl) | < 65 y.o. | 13.928 \pm 1.72 | 8.1 | 16.5 | 0.001 |
| | > 65 y.o. | 13.136 \pm 1.39 | 4.6 | 17.1 | |
| RBC (million/ μ l) | < 65 y.o. | 4.748 \pm 0.46 | 3.3 | 5.8 | 0.001 |
| | > 65 y.o. | 4.540 \pm 0.57 | 3.0 | 8.4 | |
| PLT (thousand/ μ l) | < 65 y.o. | 241.72 \pm 69.84 | 119 | 523 | 0.026 |
| | > 65 y.o. | 225.57 \pm 64.72 | 121 | 529 | |
| MCV (fl) | < 65 y.o. | 87.403 \pm 4.49 | 66.9 | 99.1 | ns |
| | > 65 y.o. | 88.039 \pm 4.83 | 73.5 | 111.0 | |
| Total cholesterol (mg/dl) | < 65 y.o. | 190.92 \pm 46.15 | 115 | 336 | 0.013 |
| | > 65 y.o. | 178.76 \pm 43.12 | 82 | 340 | |
| HDL (mg/dl) | < 65 y.o. | 47.62 \pm 13.46 | 25 | 95 | ns |
| | > 65 y.o. | 48.04 \pm 11.45 | 21 | 85 | |
| LDL (mg/dl) | < 65 y.o. | 111.86 \pm 40.94 | 39 | 254 | ns |
| | > 65 y.o. | 105.32 \pm 37.81 | 11 | 238 | |
| TG (mg/dl) | < 65 y.o. | 158.01 \pm 91.60 | 41 | 503 | 0.001 |
| | > 65 y.o. | 123.09 \pm 63.43 | 37 | 424 | |
| Fibrinogen (mg/dl) | < 65 y.o. | 402.54 \pm 99.09 | 248 | 866 | ns |
| | > 65 y.o. | 408.89 \pm 84.19 | 207 | 702 | |
| Glycaemia (mg/dl) | < 65 y.o. | 113.99 \pm 36.83 | 55 | 270 | ns |
| | > 65 y.o. | 116.18 \pm 41.45 | 70 | 449 | |
| Creatinine (mg/dl) | < 65 y.o. | 0.89 \pm 0.21 | 0.57 | 2.01 | 0.005 |
| | > 65 y.o. | 0.96 \pm 0.26 | 0.58 | 2.19 | |
| eGFR (from the formula MDRD) (ml/min/1.73 m ²) | < 65 y.o. | 100.02 \pm 21.36 | 37.47 | 157.99 | 0.001 |
| | > 65 y.o. | 87.98 \pm 23.26 | 30.52 | 144.63 | |
| Creatinine clearance (Cockcroft-Gault Equation) (ml/min/1.73 m ²) | < 65 y.o. | 116.37 \pm 28.81 | 43.74 | 210.04 | 0.001 |
| | > 65 y.o. | 73.24 \pm 20.98 | 24.45 | 129.42 | |

and amounted to approx. 80%. Beta-adrenergic antagonists, recommended for patients suffering from arterial hypertension with coexisting coronary thrombosis, and in particular after a heart attack, with symptomatic supraventricular dysrhythmia, migraine, essential tremor and hyperthyroidism (19) in our study group were applied in about 90% of patients < 65 y.o. and 87% of patients > 65 y.o.

Most studies concentrate on observance of pharmacotherapy orders by elderly people; however, observing recommendations concerning lifestyle (diet, physical activity, use of substances) also has an important influence on the process of treatment. Failure to observe medical recommendations concerning lifestyle

(so-called modifiable risk factors for cardiovascular diseases) by elderly people results in increased hospitalization rate and hence in increased financial burden related to health care and higher mortality rates (20-22).

Regardless of age, control of risk factors for cardiovascular complications in elderly people is insufficient. Control of the above-mentioned factors could be improved by means of changes in lifestyle, but they have not changed significantly over the last decade. Many epidemiological studies have shown the dependence between the occurrence of obesity and the development of arterial hypertension. It was assumed that obesity defined as BMI value \geq 30 kg/m² is a risk factor

for the development of arterial hypertension and CVD (23-25). In the analysis carried out, one out of four patients over the age of 65 was overweight, and obesity occurred in approx. 86% of patients below the age of 65.

Another modifiable factor is tobacco smoking. Nicotinic is one of the main risk factors for cardiovascular diseases, regardless of age. It is still a big problem, not only among patients with arterial hypertension and coronary thrombosis. The proportion of patients who smoked was approx. 31% in the group > 65 y.o., and approx. 18% in the group < 65 y.o. People who smoke and suffer from coronary thrombosis on average require invasive treatment 6 years earlier than those who do not smoke and 3 years earlier than those who have given up smoking (26). As for people addicted to tobacco, the risk of reocclusion of the coronary artery after PCI or occlusion of the coronary artery bypass graft is also increased (27). The risk of heart attack is 3 times higher in smokers than in non-smokers. The risk of heart attack increases by 50% when smoking up to 5 cigarettes a day, and is 4 times higher when smoking 20 cigarettes a day (28). In our work, about 48% of patients over the age of 65 had already had a heart attack and had had percutaneous coronary interventions performed before. PCI procedures do not cure sclerosis but only treat its effects. Remedial procedures are often understood as therapeutic procedures which exempt a patient from further preventive actions. It should be explained to patients that PCI procedures do not prevent advancement of sclerosis and after the

operation they still have to observe the principles of secondary prevention.

It is easier to persuade a patient to systematic use of pharmacotherapy than to stop smoking or reduce their bodily weight. Maybe during regular visits to the doctor we should give the patient comprehensible information on changing their lifestyle and systematically evaluate understanding and acceptance of the recommendations. Taking into consideration the discussions on forums as to which medication should be the first choice drug in the case of elderly people (without considering comorbidities), it seems more sensible to discuss how to prevent cardiovascular diseases by means of change of lifestyle.

CONCLUSIONS

1. Patients > 65 y.o. constituted 58% of patients referred for coronarography and were characterized by more frequent occurrence of risk factors for cardiovascular diseases than patients in younger age groups.
2. Arterial hypertension was one of the most frequent risk factors (83%) and more often occurred in the group of older patients.
3. The value of systolic blood pressure at admission and during hospitalization was significantly higher in the group of patients > 65 y.o. in comparison to the patients < 65 y.o.
4. Greater emphasis should be put on education of patients, with indication of benefits from prevention of cardiovascular diseases.

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