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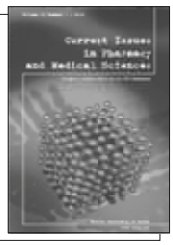

The influence of selected variables on the values of systolic pressure in patients with hypertension

JOLANTA SZYMAŃSKA[1*], ELŻBIETA PIETRYKA-MICHAŁOWSKA[2]

[1] Chair and Department of Paedodontics Medical University in Lublin
[2] Department of Mathematics and Medical Biostatics Medical University in Lublin

ABSTRACT

Hypertension is a disease of the first world and results to a great extent from leading an improper lifestyle. Some important risk factors include being overweight or obese, indulging in little physical activity, smoking and abusing alcohol. The aim of this study was to analyze the influence of some selected variables, including life-style choices, on systolic blood pressure in patients treated for hypertension. The study was conducted among 132 patients using the medical services in five randomly selected clinics in Lublin. The influence of age, sex, body mass index, physical activity and smoking on systolic blood pressure was analyzed. The study shows that systolic blood pressure depends on the selected variables. In general, however, a positive correlation was found between age and systolic blood pressure, regardless of gender. Moreover, a higher systolic blood pressure was also observed in men, as well as in individuals with low physical activity, in those who smoke and those who are overweight or obese. Our results indicate that patients with hypertension should be aware that drug therapy and lifestyle are integral components of disease treatment, and modification of their lifestyles towards leading healthy ones is a necessity.

Keywords: hypertension, systolic pressure, BMI, physical activity, smoking

INTRODUCTION

Hypertension is a first-world disease that largely results from following an incorrect lifestyle. It is one of the major risk factors for cardiovascular diseases [8], and if not treated, it increases the risk of developing serious health complications, including early death [2, 3, 10, 11]. Risk factors for hypertension include: overweight and obesity, low physical activity, alcohol abuse and smoking. Changing lifestyle, the essence of which is to eliminate the risk factors of hypertension, is an independent method of treatment for mild-to-moderate hypertension and supplements pharmacological treatment [11]. Together, the results are positive.

In this study, we analyzed the impact of selected variables (such as genetic and life-style factors) on systolic blood pressure in patients treated for hypertension.

MATERIALS AND METHODS

This study was conducted among patients treated for hypertension and under medical care in five randomly selected clinics in Lublin. The patients' height, weight and blood pressure were measured twice, taking for the further analysis, the average of two measurements. Following this, the influence of selected variables (age, gender, body mass index, physical activity and smoking), on systolic blood pressure was assessed. The results were then statistically analyzed. The values of the analyzed parameters, measured in the nominal scale, were characterized by counts and percentages. As for assessing the relationship between the analyzed traits, the χ^2 test of independence was employed. For determining the correlation between two variables, the test for the Pearson correlation coefficient was used. This study adopted a 5% error of inference and the associated level of significance of $p < 0.05$, was applied to indicate the existence of significant differences. The statistical analyzes were performed using the computer software program Statistica 9.0 (StatSoft, Poland).

The study included 132 people between the ages of 20 to 69 years. Half of these study subjects were below 45 years of age, most were people aged 56 years. The average patient's age was 44.4 ± 14.5 years. Most were women – 72 (54.5%) aged between 20 and 67 years. The mean age of those taking part in this study was 44.7 ± 13.4 years. Men participating in the survey were between 20–69 years old, with their average age being 44.1 ± 15.7 years. The observed differences were not statistically significant ($t = 0.2099$, $p = 0.834$, d.f. = 130). Systolic blood pressure of the surveyed patients suffering from high blood pressure ranged from 149 to 226 mm Hg, while the mean pressure was 176.7 ± 20.3 mm Hg. In half of the surveyed subjects, the systolic blood pressure was not higher than 174 mm Hg.

Based on weight and height, BMI (body mass index) was calculated for each patient. For adults, the following values of BMI are adopted: 18.5–24.99 – correct; 25.0–29.99 – over-

Corresponding author
* Chair and Department of Paedodontics,
Medical University in Lublin, 7 Karmelicka Str., 20-081 Lublin, Poland
e-mail address: szymanska.lublin@gmail.com

weight; 30.0–34.99 – grade I obesity; 35.0–39.99 – grade II obesity (clinical obesity), ≥ 40.0 – grade III obesity (extreme obesity) [8]. The value of BMI in the patients taking part in this study ranged from 18.6 to 37.7, while the average value of BMI of these individuals was 27.7 ± 4.8. A correct value of BMI was observed in only 35 patients. This figure accounts for little more than a quarter of all the respondents (26.5%). What is more, 57 patients (43.2%) were assessed to be overweight; while 32 patients (24.2%) graded out to be at grade I obesity and 8 patients (6.1%) were assessed as being of grade II obesity. No significant statistical differences between mean values of BMI for men and women (t = -0.83, d.f. = 130, p = 0.407) were confirmed. For women, the mean body mass index was 27.4 ± 4.7; for men, this was assessed as being 28.1 ± 5.1. The evaluation of BMI value depending on gender confirmed such a relationship ($\chi^2 = 13.87$, d.f. = 3, p = 0.003). However, significantly more often overweight and grade I obesity occurred in the men taking part in this study, while in women, significantly more often there were either correct values or grade II of obesity.

RESULTS

The analysis showed that systolic blood pressure in patients treated for hypertension is influenced by the following variables: age, sex, physical activity, body mass index and smoking. Based on the significance test for Pearson correlation coefficient (t = 16.53, p < 0.05), a strong correlation between patient age and systolic blood pressure (r = 0.82) was especially evident. This was a parallel increase in systolic blood pressure with the increasing age of the subjects (Fig. 1). Furthermore, in regard to these two variables, a regression straight was determined, describing their relationship. A high value of determination coefficient $r^2 = 0.68$ indicates that the linear regression explains about 68% of the observed variability of 'systolic pressure'. The correlation between age and systolic blood pressure separately for women and men was also examined. There is almost a complete correlation between male age and systolic blood pressure with r = 0.93, and coefficient of determination being $r^2 = 0.87$ (t = 19.51, p < 0.05), while for women, r = 0.86 while $r^2 = 0.74$ (t = 13.98, p < 0.05) (Fig. 1).

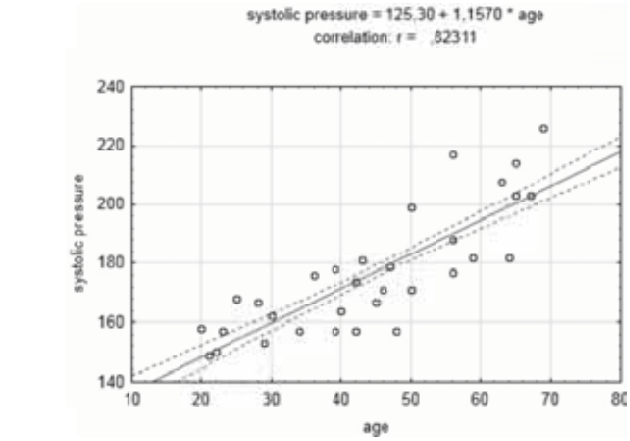

Fig. 1. Effect of age on systolic blood pressure

Systolic blood pressure in women ranged from 150 to 208 mm Hg, while in one half of the women who were surveyed, it did not exceed 165 mm Hg. In men, it ranged between 149–226 mm Hg, while half of them did not show a systolic pressure rate greater than 179 mm Hg. The mean systolic blood pressure in women was significantly lower than the average systolic blood pressure of men (t = -4.68, d.f. = 130, p < 0.05). In women it was 169.7 ± 16.1 mm Hg; in men 185.5 ± 21.8 mm Hg.

When analyzing the influence of physical activity on systolic blood pressure, it was found that physical activity has a statistically significant effect on lowering pressure levels. To recognize this, the Kruskal-Wallis test was applied (H = 74.57, p < 0.05). The data summarized in Table 1 clearly shows the positive impact of physical activity on lowering of systolic blood pressure.

Table 1. Effect of physical activity on systolic blood pressure

Physical activity	Systolic pressure (mm Hg)			
	n	minimum	maximum	median
Low	48	171	226	201
Medium	44	157	188	167
High	40	149	176	160

We utilized univariate ANOVA analysis to evaluate the mean systolic blood pressure in each group in regard to BMI. This revealed statistically significant differences (F = 11.52, p < 0.05): the average systolic blood pressure in patients with normal BMI was 153.5 mm Hg; while with those who were overweight, this was 167.4 mm Hg, whereas in subjects with grade I obesity the figure gained was 176.1 mm Hg. Furthermore, the highest recorded systolic blood pressure was found in patients with grade II obesity – 185.5 mm Hg (Fig. 2). Thus, our research reveals a positive correlation, of medium power (r = 0.38) in regard to BMI and systolic blood pressure. This means that with increasing BMI, systolic blood pressure is also increasing (Fig. 2).

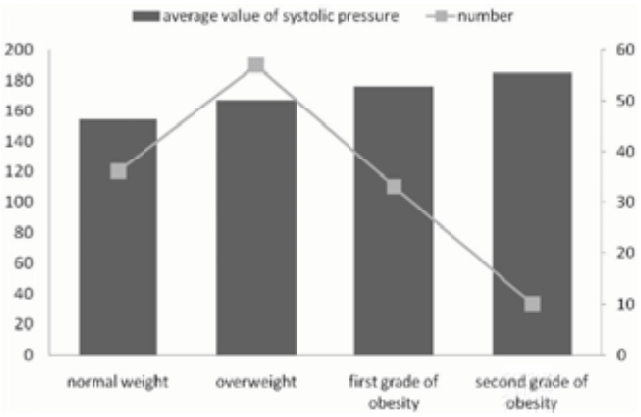

Fig. 2. Average systolic blood pressure in groups depending on body mass index

Our work also shows the impact of cigarette smoking on systolic blood pressure. In non-smoking subjects, the average systolic blood pressure was 163.4 ± 10.2 mm Hg, while in patients who were smokers, it was 187.8 ± 14.2 mm Hg. The

observed differences are statistically significant (t = -8.52, p < 0.05) (Fig. 3).

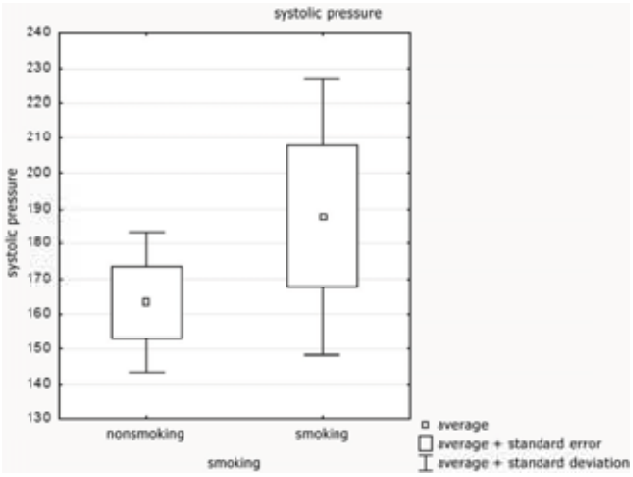

Fig. 3. The average systolic blood pressure in smokers and nonsmokers

DISCUSSION

On the basis of literary research, it is evident that cardiovascular risk increases proportionally with increasing values of both systolic and diastolic blood pressure [8,9]. Moreover, it is a problem involving particularly the older age groups [6]. This was reported by Krzysztoń et al. [7], who conducted a survey among 319 people, aged 19–80 years, who were reporting to their family doctors for a variety of reasons. Our study confirms that there is a positive correlation between age and systolic blood pressure, regardless of gender, as an analysis of the dependence of arterial blood pressure on age, shows that both the peripheral systolic blood pressure (PSBP) and central systolic blood pressure (CSBP) increased with age in a continuous manner, and the growth rate of CSBP was greater than the PSBP.

While analyzing the incidence of hypertension with regard to gender, in the aforementioned Polish epidemiological studies, it was stated that hypertension occurs less frequently in women, or at a similar rate as in men [6]. In our study, higher systolic blood pressure too, was observed in men. However, a literature research shows that the difference in systolic pressure levels between men and women may result from differences in body height, and thus the length of the arterial system, which explains the higher index and a higher incidence of alleged hypertension in men [7].

The meta-analysis of Whelton et al. [11] indicates that there is at blood pressure drop associated with regular physical exercise. This occurs regardless of the type of training, frequency and intensity. This was true, for individuals with hypertension and for individuals with normal blood pressure, as well as overweight individuals and people with normal body weight. The introduction of regular exercise reduces the average systolic blood pressure by an average of 3.8 mm Hg. It is believed that the systematic and long-term physical activity in patients with hypertension influences the lowering of systolic blood pressure by 11 mm Hg, and diastolic blood pressure by 6 mm Hg [4]. Our study confirms this, as it reveals that there are greater reductions in systolic blood pressure in active people: from 201 mm Hg in those subjects with low physical activity, to 160 mm Hg in patients with high activity.

Our study also demonstrated the adverse effects of cigarette smoking on systolic blood pressure in hypertensive patients. The average systolic blood pressure in smokers was 188 mm Hg, while in non-smokers this figure was 164 mm Hg. The correlation between cigarette smoking and the presence of elevated blood pressure was found already within the group that had as its members, students attending upper secondary school. In the group of smoking students, systolic blood pressure values significantly more often exceeded accepted standards [2].

Obesity is one of the more common risk factors for hypertension. The risk of hypertension in overweight individuals is 2-6 times higher than in slim individuals, while in patients with hypertensive disease, a weight loss of 1 kg may contribute to lowering systolic blood pressure by 1.6 mm Hg, and diastolic blood pressure by 1.3 mm Hg [4, 5]. As demonstrated in our study, higher systolic blood pressure was associated with higher body mass index (BMI). Our work also seems to confirm that of another survey that was carried out among young people of Podkarpackie Province. This shows that the predisposing factor for high blood pressure is an increase of BMI and hypertension in siblings [3]. Of our data, what is alarming is that elevated systolic and diastolic pressure values are clearly evident already in a significant proportion of young people.

Leading a healthy lifestyle is an important element in both the prevention of hypertension and in the treatment of the disease [10]. Research shows, however, that patients seldom follow this advice to mitigate the risk factors for hypertension in their lifestyles. Among the patients surveyed in a Radom hospital ward, more than half did not follow the prescribed diet and were not physically active, although 63% were overweight. People in this group, however, often restricted salt intake (75%), but less often limit cigarette smoking (31%) and alcohol consumption (20%). What was surprising amongst this research result is that those polled (70%) did not know the risk factors for hypertension [10]. It seems that health education aimed at people with hypertension and their families, as presently undertaken, is a failure. Hence, alternative ways of getting across this information would seem to be of benefit. Indeed, the studies of Bartczuk et al. [1] have shown that effective promotion of living a healthy lifestyles has a beneficial effect on lifestyle changes in patients with hypertension.

CONCLUSIONS

An analysis of the data we derived in this study clearly shows that systolic blood pressure depends on age, gender, body mass index, physical activity and smoking. Higher systolic blood pressure values were observed in the male

gender, in those who are not physically active, in those who smoke and in those either overweight or obese. What is more, there was a positive correlation between age and systolic blood pressure, regardless of gender. This was the same in regard to those who lead unhealthy lifestyles. Thus, patients with hypertension regardless of pharmacological treatment, should be familiar with and adhere to the principles of a healthy lifestyle, as this is an integral part of treatment of the disease, as well as an effective preventative.

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