

# Estimation of cardiovascular complications and death risk in subjects with metabolic syndrome

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## Abstract

**Introduction:** Coexistence of lipid and carbohydrate disorders with hypertension and obesity increases the risk of ischaemic heart disease and its complications. The recently observed lack of reduction in the incidence of cardiovascular system diseases is thought to be due to the growing epidemic of MS. The aim of the study was to estimate cardiovascular complications and death risk in subjects with MS.

**Material and methods:** The prevention study included 581 subjects (213 males and 368 females): 250 born in 1949, 155 born in 1959 and 176 born in 1969. MS was diagnosed (on the basis of NCEP ATP III) in 104 individuals. Increased risk of cardiovascular complications was determined for pulse pressure (pp) >63 mmHg. Based on the SCORE index (algorithm), 10-year death risk due to cardiovascular complications was estimated taking into account sex, age, smoking, systolic blood pressure and total cholesterol concentration. A value  $\geq 5\%$  was accepted as high risk of death within 10 years.

**Results:** Increased risk of cardiovascular complications (pp >63 mmHg) was found in 21 subjects (20.2%) with MS and 34 (7.1%) without MS ( $p < 0.05$ ). High death risk due to cardiovascular complications (within 10 years,  $\geq 5\%$ ) was diagnosed in 33 (31.7%) subjects with MS and in 38 (8%) without MS ( $p < 0.05$ ).

**Conclusions:** High risk of cardiovascular complications and death occurs statistically more frequently in subjects with MS than in the rest of the population.

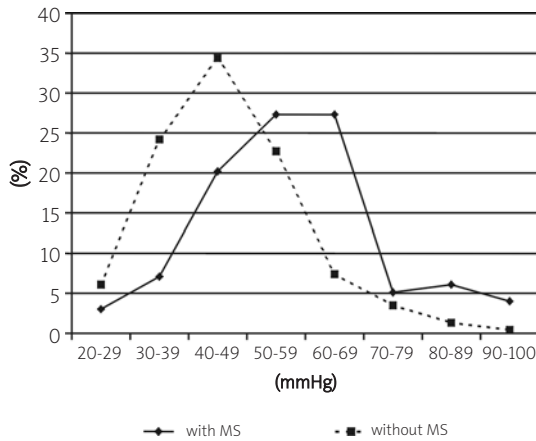
**Key words:** metabolic syndrome, cardiovascular complications, death risk, pulse pressure, SCORE index.

## Introduction

In the year 2003, 365 thousand people died in Poland. Among them, 172.6 thousand died because of circulatory system diseases [1]. This was 47% of all deaths. In the same year, the rate of premature mortality from circulatory system diseases in Poland was about 2.5 times higher than in other European Union countries. In recent years, we have observed a slow-down of declining tendencies in cardiovascular mortality, partly because of an epidemic of metabolic syndrome (MS). A permanent increase of people with MS is observed. The NATPOL PLUS study in 2002 showed that metabolic syndrome occurs in about 20.3% of adult inhabitants of Poland, which means about 5.9 million people [2].

It is estimated that MS will soon be the first risk of heart diseases after smoking.

Clinical trials also show that diagnosis of metabolic syndrome is connected with worsening of prognosis in these subjects [3-6]. In this context we began our studies to estimate cardiovascular complications and death risk in subjects with MS.



**Figure 1.** The pressure amplitude (pulse pressure) in subjects with and without MS

**Material and methods**

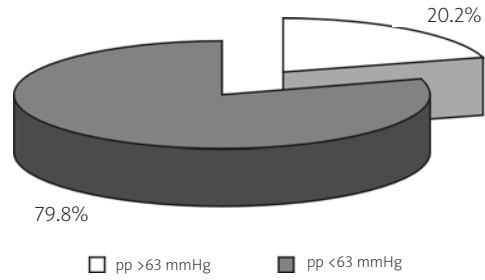
The study comprised 104 patients (47 men, 57 women), aged 48.65±7.89 years, with metabolic syndrome diagnosed on the basis of NCEP ATP III criteria. The reference group comprised 477 healthy subjects (166 men, 311 women), aged 47.95±7.94 years, especially without cardiovascular system diseases.

Estimation of the risk of cardiovascular complications in subjects with and without MS was accomplished based on pulse pressure (pp) value. Increased risk was determined for pulse pressure (pp) >63 mmHg [7]. Based on the SCORE index (algorithm), 10-year death risk due to cardiovascular complications was estimated taking into account sex, age, smoking, systolic blood pressure and total cholesterol concentration. A value ≥5% was accepted as high risk of death within 10 years [8].

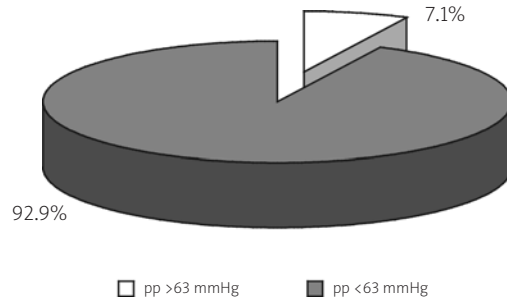
The study has been approved by the Local Ethics Committee of the Medical University in Lodz (Nr RNN/248/04/KB). Statistical analyses were performed with STATISTICA 5.1 PL Software.

**Results**

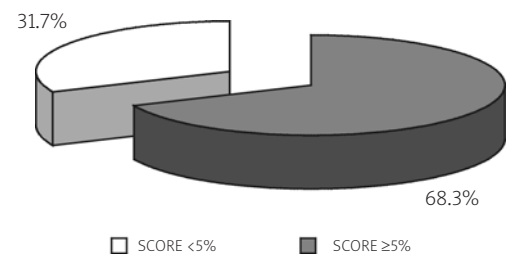
Increased risk of cardiovascular complications (pp >63 mmHg) was found in 21 subjects (20.2%) with MS and 34 (7.1%) without MS (p<0.05) (Figures 1-3). In the group of subjects with MS increased pulse pressure was equally found both in men and women (21.3% vs 19.3%, p>0.05). In the group of subjects without MS increased pulse pressure was more frequently found in men than in women (9.6% vs 5.8%, p<0.05). High death risk due to cardiovascular complications (SCORE ≥5%) was diagnosed in 33 (31.7%) subjects with MS and in 38 (8%) without MS (p<0.05) (Figures 4, 5). In the group of subjects with and without MS, SCORE ≥5% was equally found both in men and women.



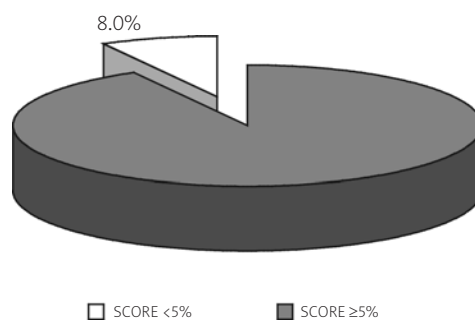
**Figure 2.** The risk of cardiovascular complications in subjects with metabolic syndrome



**Figure 3.** The risk of cardiovascular complications in subjects without metabolic syndrome



**Figure 4.** The 10-year death risk due to cardiovascular complications in subjects with MS



**Figure 5.** The 10-year death risk due to cardiovascular complications in subjects without MS

**Discussion**

Blood pressure, both systolic and diastolic, increases with age, independently of gender. But in later decades, systolic blood pressure increases with simultaneous decrease in diastolic pressure. For that

reason, in elderly people often isolated systolic hypertension is diagnosed, which is connected with high pulse pressure. The basic mechanism leading to increase in pulse pressure is stiffening of the large elastic arteries [9]. These vessels carry blood to the tissues and provide regular flow in vessel bearing, through minimization of pulsation caused by intermittent ejection of blood from the left ventricle. Thanks to adhesive-elastic properties, the portion of blood ejected from the heart during systole is stored within vessels and then returns to the periphery during diastole. Blood pressure reaches a maximum value during systole. It is higher if the wall of the vessel is stiffer. Simultaneously, an inflexible vessel wall causes a decrease in diastolic blood pressure, as a result of fast outflow of blood from the vessels. Therefore greater stiffness of arteries causes an increase in systolic blood pressure with a simultaneous decrease in diastolic blood pressure [10].

Beside dangers connected with increased blood pressure, epidemiological observations have paid attention to the harmfulness of increased pulse pressure. During the 30-year Framingham study it was proved that higher pulse pressure increases the risk of cardiovascular complications [11]. The studies of Benetos et al. showed that pulse pressure is a strong predictor of myocardial infarction in men [12]. Madhavan et al. came to the same conclusion [13]. The Hypertension Detection and Follow-up Program study proved that pulse pressure is a significant predictor of total mortality [14]. Similar results were obtained among patients with isolated systolic hypertension in the study of Staessen et al. [15]. Mitchel et al. in a clinical intervention trial carried out among patients with heart failure after myocardial infarction found that alongside increased pulse pressure, the risk of total mortality and new myocardial infarction increases [16]. In the 5.5-year study of Millar et al., carried out among subjects with mild hypertension, it was found that high pulse pressure increases the risk of coronary episodes [17].

In our own studies, increased pulse pressure (>63 mmHg) was identified in every fifth subject with MS. In addition, estimation of pressure amplitude in patients with MS showed that most of the values were situated in ranges with great pressure amplitude.

Raised pulse pressure (>63 mmHg) is an independent factor of coronary episodes, and increases the risk of total, coronary and cardiovascular mortality. But despite the dangers associated with increased pulse pressure, there is a lack of clinical trials indicating that it is an alterable risk factor [7].

Coexistence of many risk factors has an influence on development of atherosclerotic changes, including components of MS. Total risk of appearance of coronary heart disease is defined as a resultant of the cumulation of these components. In order to estimate this risk, the First Joint Task Force of the

European Societies on Coronary Prevention worked out the guidelines based on risk factors published by investigators in the Framingham Study. However, some reservations appeared about its use in the European population and difficulties in adapting local data as a model for particular countries. For that reason, the European Society of Cardiology, using data from European cohort studies (including countries with populations at lower risk such as France, Italy and Spain), created an algorithm estimating 10-year death risk due to cardiovascular complications (not only the risk of coronary disease), individual for populations at low and high risk [18].

The SCORE (Systematic Coronary Risk Evaluation) algorithm takes into account total cholesterol concentration and systolic blood pressure, separately for women and men as well as for smokers and non-smokers. The age range of patients estimated by the SCORE index is 40-65 years, because the risk in subjects below 40 years is very low. It is generally accepted that patients with coronary heart disease, high blood pressure and diabetes are at high risk of cardiovascular death [19].

In the SCORE index, high risk of death ( $\geq 5\%$ ) corresponds to 20% risk of a cardiovascular event. In our studies, these criteria were fulfilled in almost 32% of subjects with MS. High risk of cardiovascular death was equal in both men and women. In addition, in the group of subjects without MS, the percentage of patients with high risk of cardiovascular death was nearly four times smaller than in the group of subjects with MS, and amounted to about 8%. In all studied groups, men had lower risk of cardiovascular death than women.

In the SCORE algorithm, from among cardiovascular risk factors, only age, sex, total cholesterol concentration, systolic blood pressure and smoking were taken into account. However, European guidelines on cardiovascular disease prevention point out that cardiovascular risk may be higher in obese subjects, with early familial coronary artery disease, low HDL cholesterol level, high triglyceride level, carbohydrate disorders, increased levels of CRP and fibrinogen, hyperhomocysteinemia and also in asymptomatic subjects with evidence of atherosclerosis based on imaging examinations. Some of the risk factors mentioned above refer to patients with MS and therefore the real percentage of studied subjects with high risk of death within 10 years is probably higher

## Conclusions

1. High risk of cardiovascular complications and death occurs statistically more frequently in subjects with MS than in the rest of the population.
2. There is a necessity for early identification of subjects with MS, in order to reduce the risk of cardiovascular complications and death.

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