

REVIEW / PRACA POGLĄDOWA

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METABOLIC SYNDROME – EPIDEMIOLOGICAL PROBLEM?**ZESPÓŁ METABOLICZNY – PROBLEM EPIDEMIOLOGICZNY?**

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S u m m a r y

The main components of the metabolic syndrome (MetS) are abdominal obesity, hypertension, lipid disorders such as atherogenic dyslipidemia and carbohydrates disorders such as impaired fasting glucose or diabetes mellitus type 2

The first definition of MetS was described by Reaven in 1988 and was named as syndrome X.

In the United States of America, the metabolic syndrome affects about 25 % of US adults. In Poland, data based on NATPOL PLUS study, according to NCEP-ATP III criteria, metabolic syndrome was ascertained in 20.3% of adult inhabitants, and taking into account IDF criteria MetS was recognized in 26.2% of investigated people. All components of the metabolic syndrome, such as abdominal obesity, hyperglycemia, hypertension and lipid disturbances (atherogenic dyslipidemia) together with age become more

and more frequent, which leads to the increase of MetS in general population.

The diagnosis of the metabolic syndrome is connected with about 3-4-times increase of the cardiovascular risk and it is to separate patients with cardiovascular episodes in possibly earliest clinical phase. It is diagnosed more and more frequently connected mostly with the increase of the number of people with the abdominal stoutness and growing insulin resistance.

It is the world epidemiological problem, which should be fought against on the spot. It is an indication to initiate a suitable diet and the recommendation of a suitable physical effort for the purpose of initial prophylaxis. Certainly, pharmacological treatment should be initiated if necessary.

S t r e s z c z e n i e

Głównymi elementami zespołu metabolicznego są otyłość brzuszna, nadciśnienie tętnicze, zaburzenia lipidowe pod postacią dyslipidemii aterogennej oraz zaburzenia gospodarki węglowodanowej pod postacią nieprawidłowej glikemii na czczo oraz cukrzycy typu 2.

Pierwsza definicja zespołu metabolicznego została sformułowana przez Reavena w 1988 roku i nazwana zespołem X.

W Stanach Zjednoczonych zespół metaboliczny występuje u około 25% dorosłych obywateli. W Polsce, na podstawie danych z badania NATPOL PLUS, zgodnie z przyjętymi kryteriami NCEP-ATP III, zespół metaboliczny został rozpoznany u 20,3% osób dorosłych, natomiast zgodnie z kryteriami IDF u 26,3% badanych. Wszystkie składowe zespołu metabolicznego, takie jak otyłość brzuszna, hiperglikemia, nadciśnienie tętnicze oraz

zaburzenia lipidowe (dyslipidemia aterogenna) stają się coraz częstsze u osób starszych i prowadzą do wzrostu jego występowania w ogólnej populacji.

Obecność zespołu metabolicznego wiąże się z około 3-4-krotnym wzrostem ryzyka sercowo-naczyniowego i ma wyodrębnić chorych zagrożonych epizodami sercowo-naczyniowymi w możliwie jak najwcześniejszym stadium klinicznym. Jest on rozpoznawany coraz częściej i związany jest głównie ze zwiększeniem liczby osób z otyłością brzuszna i narastającą insulinoopornością.

Jest to światowy problem epidemiologiczny, z którym trzeba walczyć w sposób intensywny. Jest wskazaniem do wdrożenia odpowiedniej diety oraz zalecenia odpowiedniego wysiłku fizycznego w celu pierwotnej profilaktyki. Oczywiście, jeżeli jest to konieczne, dodatkowo należy wdrożyć leczenie farmakologiczne.

Key words: metabolic syndrome, insulin resistance, obesity

Słowa kluczowe: zespół metaboliczny, insulinooporność, otyłość brzuszna

INTRODUCTION

The main components of the metabolic syndrome (MetS) are abdominal obesity, hypertension, lipid disorders such as atherogenic dyslipidemia and carbohydrates disorders such as impaired fasting glucose or diabetes mellitus type 2 [1].

The first definition of MetS was described by Reaven in 1988 and was named as syndrome X. All of the parameters of metabolic syndrome, which are risk factors associated with cardiovascular disease, without central obesity, were included in it [2]. He suggested that insulin resistance played the main role in pathogenesis of MetS.

In 1999 the World Health Organization determined the criteria of MetS based on carbohydrates disorders, such as impaired fasting glucose and/or impaired glucose tolerance and/or diabetes mellitus and/or insulin resistance and at least two of risk's factors [3]:

- hypertension: systolic blood pressure ≥ 140 mmHg/ or diastolic blood pressure ≥ 90 mmHg or using of drugs for hypertension
- abdominal obesity based on body mass index $> 30 \text{ kg/m}^2$ or relation of waist to hip ratio > 0.85 in females and > 0.9 in males
- microalbuminuria evaluated on the basis of albuminuria $> 20 \mu\text{g/min}$ or albuminuria/creatinuria ratio $\geq 30 \text{ mg/g}$
- atherogenic dyslipidemia: plasma triglycerides (TG) $> 150 \text{ mg/dl}$ (1.7 mmol/l) and high-density lipoprotein plasma cholesterol (HDL-C) $< 40 \text{ mg/dl}$ (1.0 mmol/l) in females and $< 35 \text{ mg/dl}$ (0.9 mmol/l) in males

This definition of MetS is not being used in general diagnosis nowadays. It is connected with difficult access to metabolic clamp – the golden standard to estimate the insulin resistance, and second difficult is to evaluate microalbuminuria.

The next criterion of recognition of metabolic syndrome (MetS), defined as insulin resistance syndrome in people without diabetes were criteria of the European Group for the Study of Insulin – EGIR. They obtained insulin resistance or hyperinsulinemia and two of four mentioned factors:

- fasting serum glucose $\geq 110 \text{ mg/dl}$ (6.1 mmol/l)
- atherogenic dyslipidemia: TG $\geq 176 \text{ mg/dl}$ (2.0 mmol/l) and/or HDL-C $< 40 \text{ mg/dl}$ (1.0

mmol/l) or treatment of lipid disorders (disturbances)

- hypertension: systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and/or treatment of hypertension
- waist circumference ≥ 80 cm in females, ≥ 94 cm in males

A disadvantage of above-mentioned criteria was to mark insulinemia and foreclosure of patients with diabetes mellitus, where additional diseases, components of MetS appeared. An advantage of EGIR's criteria was estimation of waist, which is better than body mass index as the meter of celiac adipose tissue together with foreclosure of evaluation of microalbuminuria in metabolic syndrome's [4].

Two following definitions of the metabolic syndrome are generally used in practice nowadays and have diagnostic meaning.

The report of American experts of the National Cholesterol Education Program Adult Treatment Panel III – NCEP-ATP III was published in 2001. In 2005 it was modified on the basis of the position of the American Heart Association (AHA) and the National Heart, Lung and Blood Institute (NHLBI). The metabolic syndrome can be recognized when 3 of 5 criteria are ascertained [5]:

1. abdominal obesity – waist circumference > 88 cm in females and > 102 cm in males
2. systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or treatment of hypertension
3. plasma triglycerides $\geq 150 \text{ mg/dl}$ (1.7 mmol/l) or treatment of lipid disorders
4. high-density lipoprotein plasma cholesterol (HDL-C) $< 50 \text{ mg/dl}$ (1.3 mmol/l) in females and $< 40 \text{ mg/dl}$ (1.0 mmol/l) in males
5. fasting serum glucose $\geq 100 \text{ mg/dl}$ (5.6 mmol/l) or treatment of carbohydrates disorders

Also in 2005 the International Diabetes Federation (IDF) presented on the congress in Berlin the definition of the MetS. It contained central obesity measured by waist circumference in European females ≥ 80 cm and European males ≥ 94 cm and additionally present at least 2 from 4 after-mentioned factors [7]:

1. systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or treatment of hypertension
2. plasma triglycerides $\geq 150 \text{ mg/dl}$ (1.7 mmol/l) or treatment of lipid disorders

3. high-density lipoprotein plasma cholesterol (HDL-C) < 50 mg/dl (1.3 mmol/l) in females and < 40 mg/dl (1.0 mmol/l) in males
4. fasting serum glucose \geq 100 mg/dl (5.6 mmol/l) or treatment of carbohydrates disorders

The advantage of two last definitions of the metabolic syndrome is easy estimation of parameters entering into his composition and simple verification in outpatients' clinic. (basic health care).

EPIDEMIOLOGY

In the United States of America, the metabolic syndrome affects about 25 % of US adults (data on the based NHANES III research) [7]. The diagnosis is based on the NCEP-ATP III definition [8].

In Poland, data based on NATPOL PLUS study, according to NCEP-ATP III criteria, metabolic syndrome was ascertained in 20.3% of adult inhabitants, and, taking into account IDF criteria, MetS was recognized in 26.2% of investigated people.

All components of the metabolic syndrome, such as abdominal obesity, hyperglycemia, hypertension and lipid disturbances (atherogenic dyslipidemia) together with age become more and more frequent, which leads to the increase of MetS in general population [8].

Frequency of metabolic syndrome depending on sex was not shown in the USA under examination NHANES III, however, in Poland we noticed significantly higher percentage of women than men, where the metabolic syndrome's criteria were implemented.

COMPONENTS OF THE METABOLIC SYNDROME

Abdominal obesity

The epidemic of the abdominal stoutness has been increasing worldwide and is considered as the most frequent component of the metabolic syndrome. Enlarged quantity of the visceral adipose tissue (VAT) in the metabolic syndrome is the result of the pathology of the adipose tissue conditioned by the positive energy balance. This leads to the limited possibility of the subcutaneous adipose tissue to accumulate fatty acids and to ectopically congregate the adipose tissue within muscles, liver and pancreas [9].

The adipose tissue is at present recognized as the organ of incretion, both local and systemic active substances. The most crucial meaning is considered in connection with adipocines and adipocytokines. The development of the arteriosclerosis was proved in relation with aforementioned [10].

According to the definition, NCEP-ATP III supplemented with position on the abdominal stoutness at women is recognized when the circuit of the waist exceeds 88 cm, at men 102 cm. According to the IDF classification at Europeans, the circuit of the waist \geq 94 cm at males and \geq 80 cm at females proves the abdominal stoutness.

Disturbances of the carbohydrate balance

The concentration of fasting plasma glucose \geq 100 mg/dl and diagnosed and treatment diabetes mellitus is one of the components of the metabolic syndrome.

One ought to remember that in both the classification NCEP-ATP III and IDF the irregular tolerance of appointed glucose in the test of the oral charge with glucose (140-199 mg/dl) performed after two hours from ingestion of solution 75 g of glucose was not taken into account.

The change of lifestyle and introduction of the suitable reductive diet is more effective, than oral diabetic medicines [11]. Instead, the settlement of glycaemia causes the considerable reduction of complications connected with angiopathy.

Triglycerides

Hypertriglyceridemia is mostly caused by insulin resistance. It is a frequent element of both the metabolic syndrome and diabetes type 2. The mechanism, in the course of which the development of hypertriglyceridemia in the metabolic syndrome happens, consists of the enlargement of the synthesis of VLDL in the liver and the diminution of the hydrolysis of triglycerides contracted in chylomicrons and VLDL because of the decrease of the activity of the lipoprotein present lipase in the vascular endothelium of circumferential tissues.

Hypertriglyceridemia is an independent factor of the risk of the coronary disease [12]. One ought to aim to the achievement of the value of the approach < 150 mg/dl both at men and women, using not pharmacological methods - the suitable reductive diet and the physical effort and pharmacological methods:

statines to the value 500 mg/dl and fibrates or the nicotinic acid above 500 mg/dl because of the threat of acute inflammation of the pancreas [13]. One ought to remember about monitoring of the level of aminotransferases and the creatin kinase because of the activity of hepatotoxic medicines decreasing of cholesterol level.

The cholesterol of HDL-C

The HDL-C shows the inverse correlation with relation to the frequency of the occurrence of the coronary disease [14]. The protective activity HDL-C is connected with the inverse transport of the cholesterol i.e. from tissues to the liver. In the metabolic syndrome the lowered concentration of the fraction HDL-C < 40 mg/dl at men and < 50 mg at women appears quite often. It is possible to enlarge the concentration of HDL-C by the use of the suitable reductive diet, enlargement of the physical effort and the use of fibrates which activates PPAR α receptors and enlarges the expression of the gene for the lipoprotein lipase.

Hypertension

Values of arterial tension $\geq 130/85$ mmHg in both classifications fulfill guidelines of the metabolic syndrome.

DISCUSSION

The diagnosis of the metabolic syndrome is connected with about 3-4-times increase of the cardiovascular risk and it is to separate patients with cardiovascular episodes in possibly with as earliest clinical phase. It is diagnosed more and more frequently connected mostly with the enlargement of the number of people with the abdominal stoutness and growing insulin resistance [8]. The number of patients increases together with the age [8].

Within last years of research one has ascertained that main components of the metabolic syndrome often accompany: hyperuricemia, microalbuminuria, the dysfunction of the endothelium and the prothrombotic together with the proinflammable states, therefore research has last over new markers which are found besides 5 components of the metabolic syndrome, such as C-reactive protein, fibrinogen, LDL-C and apolipoprotein B and adiponectin, leptin, AT1 etc.

The metabolic syndrome is the component of risk factors of the future coronary disease and diabetes type 2. It is the world epidemiological problem, necessary to fight intensively with on the spot. It is an indication to initiate a suitable diet and the recommendation of a suitable physical effort for the purpose of initial prophylaxis. Certainly, pharmacological treatment should be initiated if necessary.

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