Metabolic syndrome

What is metabolic syndrome?

Metabolic syndrome refers to a clustering of cardiovascular disease (CVD) risk factors, particularly abdominal obesity, insulin resistance, hypertension, and hyperlipidaemia.[1]

Metabolic syndrome is also associated with an increased risk of some common cancers.[2] [3]

However, there is uncertainty as to whether all patients with metabolic syndrome are indeed insulin-resistant, so the aetiology has been broadened to include concepts of obesity, adipose tissue disorders and other factors.[4]

Metabolic syndrome is common in adults and can also occur in obese children. Metabolic syndrome can also occur in lean individuals, suggesting that obesity is a marker for the syndrome, not a cause.[5]

Diagnostic criteria

There have been various definitions of the metabolic syndrome since 1998. The International Diabetes Federation (IDF) and American Heart Association (AHA) definition in 2009 was as follows:[6]

Any three (or more) of the following factors constitute a diagnosis of metabolic syndrome:

- Abdominal obesity: waist circumference in men ≥102 cm and in women ≥88 cm.

- Raised triglycerides:
    - >150 mg/dL (1·7 mmol/L).
    - Or specific treatment for this lipid abnormality.
- Reduced HDL-cholesterol:
    - <40 mg/dL (1·03 mmol/L) in men.
    - <50 mg/dL (1·29 mmol/L) in women.
    - Or specific treatment for this lipid abnormality.
- Raised blood pressure:
    - Systolic ≥130 mm Hg.
    - Diastolic ≥85 mm Hg.
    - Or treatment of previously diagnosed hypertension.
- Raised fasting plasma glucose:
    - Fasting plasma glucose ≥110 mg/dL (6.1 mmol/L).

    Most people with type 2 diabetes will have metabolic syndrome based on these criteria.

The IDF proposed a definition for children and adolescents in 2007:[7]

- Aged 6-9 years: waist circumference 90th percentile; however, metabolic syndrome cannot be diagnosed but further measurements should be made if there is a family history of metabolic syndrome, type 2 diabetes, dyslipidaemia, CVD, hypertension and/or obesity.

- Aged 10-15 years: waist circumference ≥90th percentile or adult cut-off if lower:

    - Triglycerides ≥1.7 mmol/L (≥150 mg/dL), HDL-C <1.03 mmol/L (<40 mg/dL)
    - Systolic blood pressure ≥130 or diastolic blood pressure ≥85 mm Hg
    - Fasting blood glucose ≥5.6 mmol/L (100 mg/dL)

- Aged 16+ years: use existing IDF criteria for adults.

How useful is the concept of metabolic syndrome?

More recently, the usefulness of the 'metabolic syndrome' concept has been questioned - at least in so far as clinical practice is concerned.[8]

There have been mixed results from studies examining metabolic syndrome's comparative ability in predicting CVD and type 2 diabetes over traditional risk models. Despite this, the term metabolic syndrome continues to be used both in clinical practice and in research.[9]

Although the metabolic syndrome appears to have limited utility for the identification of individuals at increased risk of type 2 diabetes or CVD, the diagnosis of metabolic syndrome presents an opportunity to deliver co-ordinated care to those with metabolic syndrome.[10]

Some studies have found significant association with metabolic syndrome - eg, can identify people with diabetes without prior CVD who have a lower risk of future cardiovascular events.[11]

How common is metabolic syndrome?[12]

- Metabolic syndrome is a growing epidemic throughout the world. Approximately 1 adult in every 4 or 5, depending on the country, has metabolic syndrome.
- The incidence increases with age; it has been estimated that in people over 50 years of age, metabolic syndrome affects more than 40% of the population in the USA and nearly 30% in Europe.

- The worldwide prevalence of obesity has doubled in a period of two decades. The prevalence of obesity and metabolic syndrome varies between different countries and ethnic groups.[13]

Metabolic syndrome causes (aetiology)[9]

There are many different factors that contribute to the development of metabolic syndrome. Genetics, lifestyle (such as diet and physical activity), obesity and insulin resistance can all play a role. However, insulin resistance is thought to play a major role in connecting the different components of metabolic syndrome and adding to the syndrome's development. Elevated free fatty acids and abnormal adipokine profiles can result in insulin resistance and can contribute to the pathogenesis of metabolic syndrome.

Metabolic syndrome treatment and management[9]

See also the separate Prevention of Cardiovascular Disease and Prevention of Type 2 Diabetes articles. The management of the metabolic syndrome is not specific to the syndrome but comprises:

- Management of the underlying risk factors for CVD and diabetes (see 'Lifestyle advice for people with metabolic syndrome', below).
- Treatment of any established disease such as hypertension, heart disease, diabetes or chronic kidney disease.
- Evaluation and treatment of all CVD risk factors without regard to whether a patient meets the criteria for diagnosis of the metabolic syndrome.

CVD risk factors to evaluate and treat[14]

- Lifestyle - smoking, physical inactivity, unhealthy diet.
- Hypertension.
- Obesity.
- Adverse lipid profile.
- Hypercoagulation.

Unalterable risk factors are age, sex, race, family history.

See also the article on Cardiovascular Risk Assessment.

Lifestyle advice for people with metabolic syndrome[15]

Lifestyle modifications are effective in resolving metabolic syndrome and reducing the severity of related abnormalities (fasting blood glucose, waist circumference, systolic and diastolic blood pressure, and triglycerides) in people with metabolic syndrome.[16]

Exercise

- An increase in overall levels of sustained physical activity and avoidance of prolonged sedentary behaviour are important for reduction of CVD risk.
- Emphasise walking, cycling and other aerobic physical daily activities, at moderate intensity, as part of an active lifestyle, for at least 150 minutes per week in bouts of at least ten minutes, or 75 minutes per week of vigorous physical activity, or a combination of the two.
- Muscle-strengthening activities performed on at least two occasions per week.
- Exercise training, incorporating a warm-up and cool-down period, should be performed at moderate to high intensity two to three times per week for 30-40 minutes each time.
- The mode of exercise should be aerobic and where possible, continuous, allowing for a steady progression in effort - eg, walking programmes, cycling, jogging, swimming.
- The time spent exercise training contributes to meeting the 150 minutes per week of physical activity recommendation.

Weight loss

Weight reduction is important for those with abdominal obesity and the metabolic syndrome. See also the separate Obesity in Adults and Obesity in Children articles.

Diet composition

- Consume five portions per day of fruit and vegetables.
- Consume at least two servings of fish (preferably oily) per week.
- Consider regular consumption of whole grains and nuts..
- There is evidence showing that subjects adherent to a Mediterranean diet have lower prevalence and incidence rates of metabolic syndrome than those non-adherent.[17]
- Fats:
    - 'Low fat' is too simplistic and may even be detrimental. The composition of dietary fats is more important.
    - Keep intake of saturated fat to less than 10% of total fat intake (preferably in lean meat and low-fat dairy products).
    - Replace saturated fat with poly-unsaturated fat where possible.
    - Avoid 'trans fats' (often labelled as 'hydrogenated' or 'partially hydrogenated' vegetable oils) as they are harmful and linked to cardiovascular disease.
    - Avoid/reduce consumption of processed meats or commercially produced foods which tend to be high in salt and trans fatty acids.
    - Increase the proportion of mono-unsaturated fats (eg, olive oil).
    - Increase the amount of omega-3 polyunsaturated fatty acids (PUFAs) compared with a Western diet.
- Carbohydrates: avoid or reduce consumption of refined carbohydrates, such as white bread, processed cereals, sugar-sweetened beverages, and calorie-rich but nutritionally poor snacks, such as sweets, cakes and crisps.
- Keep salt consumption below 6 g per day.

Other lifestyle factors

- Smoking cessation.
- Avoid excessive alcohol consumption.

Drug treatment for metabolic syndrome

- The manifestations and complications of metabolic syndrome should be treated according to established guidelines for the treatment of hyperlipidaemia, CVD, hypertension and diabetes. This may therefore involve the use of:

    - Low-dose aspirin.
    - Antihypertensives.
    - Statins and/or fibrates.
    - Antidiabetic drugs.

See also the separate Managing Impaired Glucose Tolerance in Primary Care article.

Follow-up

Regular follow-up to monitor progress in reducing cardiovascular risk and the risk of developing type 2 diabetes.

Further reading

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