Metabolic Syndrome

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Metabolic Syndrome

- Dysmetabolic syndrome
- Hypertriglyceridemic waist
- Insulin resistance syndrome
- Obesity syndrome
- Syndrome X
- Deadly quarlet

What is Metabolic Syndrome?

Introduction

- The term "metabolic" refers to the biochemical processes involved in the body's normal functioning.
- Affects about 23 percent of adults and places them at higher risk of cardiovascular disease, diabetes, stroke and diseases related to fatty buildups in artery walls
- The underlying causes of metabolic syndrome include overweight and obesity, physical inactivity, genetic factors and getting older.

Metabolic syndrome

- **Metabolic syndrome** is a clustering of at least three of the five following medical conditions:
  - Central obesity,
  - High blood pressure,
  - High blood sugar,
  - High serum triglycerides,
  - Low serum high-density lipoprotein (HDL)

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Metabolic syndrome occurs when a person has three or more of the following measurements:

- Abdominal obesity (Waist circumference >40 inch in men, & >35 inch in women)
- Triglyceride level of 150mg/dL or greater
- HDL cholesterol of <40mg/dL in men or <50mg/dL in women
- Systolic blood pressure 130mm Hg or greater, or diastolic blood pressure 85mm Hg or greater
- Fasting glucose of 100 mg/dL or greater

Epidemiology

- AHA estimates 47 million Americans have metabolic syndrome.
- Metabolic syndrome is more common in black women and Hispanic women than in men of the same ethnic groups.
- It also affect children. Worldwide, incidence ranges from 15% to 50% among children ages 6 to 16.
- 5 times higher risk for developing type 2 diabetes.

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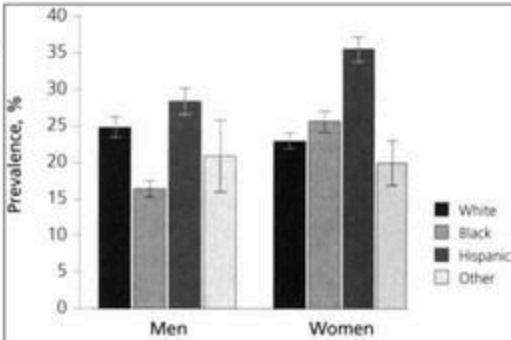
- Affects as many as one in four american adults (25%)
- For adults over the age of 40, more than 40% are affected.
- Metabolic syndrome prevalence has increased by 61% over the past decade.
- Rates differ among races and genders.



National Health and Nutrition Examination Survey III, 1988-1994.

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- It is also very common in India, more than 10 million cases per year
- Found 24.9 % in males and 42.3% in females
- Older age, female gender, general obesity, inadequate fruit intake, hypercholesterolemia, and middle-to-high socioeconomic status significantly contributed to increased risk of **metabolic syndrome**

Conditions linked to Metabolic Syndrome

- Fatty liver
- Polycystic ovarian syndrome
- Sleep disorders
- Stress and depression increase CVD risk.
- Impaired glucose handling/insulin resistance

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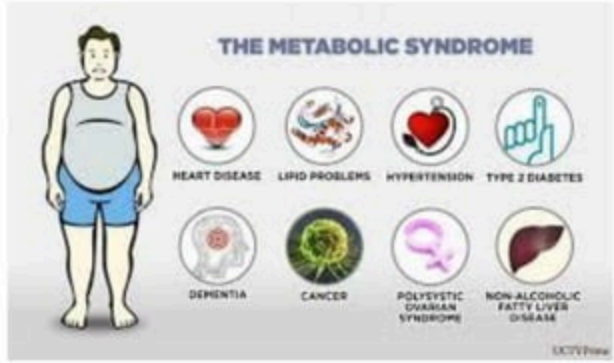
- Atherogenic dyslipidemia
- Endothelial dysfunction
- Prothrombotic state
- Hemodynamic changes
- Pro-inflammatory state
- Excess ovarian testosterone production



Risk Factors

- Overweight and obesity
- Inactive lifestyle
- Insulin resistance
- Growing older
- Ethnicity and family history

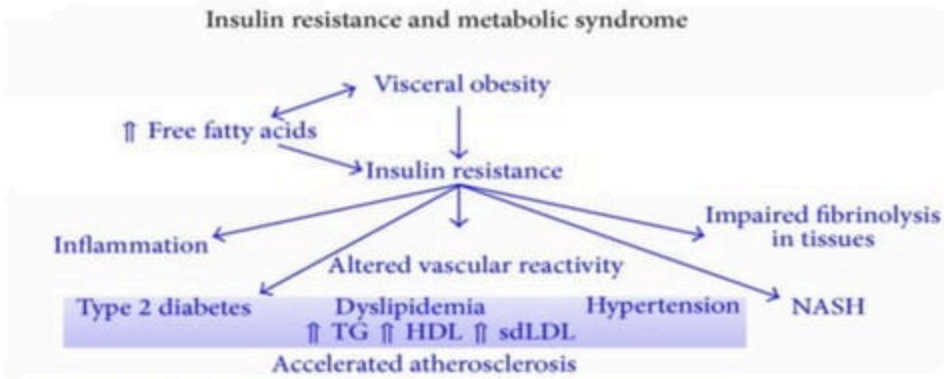
- High Fasting Blood Sugar
- High Blood Pressure
- Low HDL Cholesterol
- High Triglyceride Level

- People who have metabolic syndrome often have two other conditions: excessive blood clotting and constant, low-grade inflammation throughout the body.

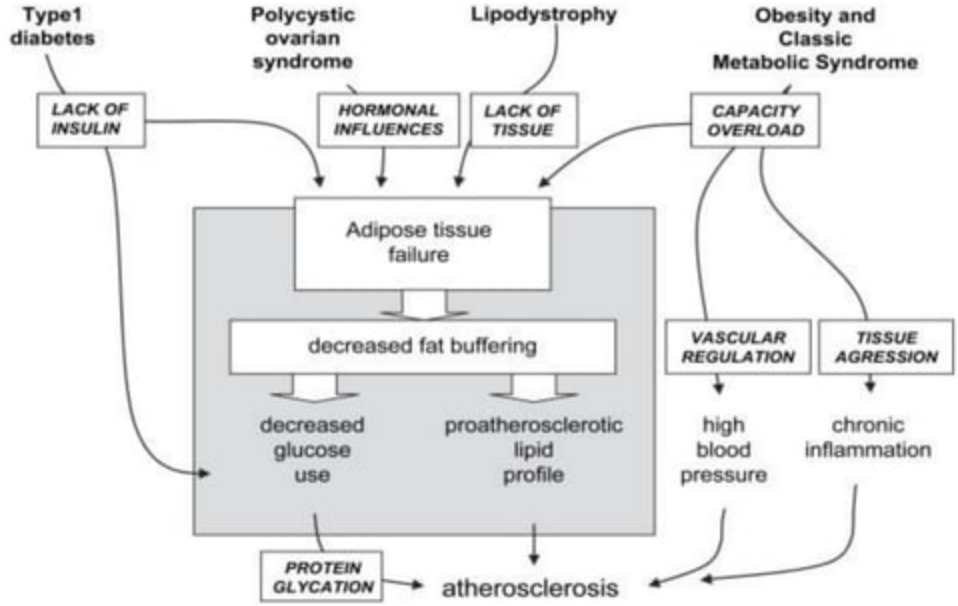
Risk Factor Contd...

Age	The prevalence of metabolic syndrome increases with age, affecting less than 10% of people in their 20s and 40% of people in their 60s.
Race	Metabolic syndrome is generally more common among blacks and Mexican-Americans than among Caucasians.
Obesity	A body mass index (BMI) greater than 25 increases your risk of metabolic syndrome and abdominal obesity increase the risk of MS. Abdominal obesity refers to having an apple shape rather than a pear.
History of diabetes	Having a family history of type 2 diabetes or diabetes during pregnancy (gestational diabetes) increases the risk for developing metabolic syndrome.
Other diseases	A diagnosis of hypertension, cardiovascular disease (CVD) or polycystic ovary syndrome (a hormonal disorder in which a woman's body produces an excess of male hormones) also increases the risk for metabolic syndrome.

Pathophysiology



NASH = nonalcoholic steatohepatitis
TG = triglycerides; HDL = high density lipoprotein; sdLDL = small dense LDL


Type1 diabetes
Polycystic ovarian syndrome
Lipodystrophy
Obesity and Classic Metabolic Syndrome
LACK OF INSULIN
HORMONAL INFLUENCES
LACK OF TISSUE
CAPACITY OVERLOAD
Adipose tissue failure
decreased fat buffering
decreased glucose use
proatherosclerotic lipid profile
VASCULAR REGULATION
TISSUE AGRESSION
high blood pressure
chronic inflammation
PROTEIN GLYCATION
atherosclerosis

Clinical Manifestations

- The key sign of metabolic syndrome is central obesity, also known as visceral, male-pattern or apple-shaped adiposity.
- It is characterized by adipose tissue accumulation predominantly around the waist and trunk.

Other signs of metabolic syndrome include

- High blood pressure
- Decreased fasting serum HDL cholesterol
- Elevated fasting serum triglyceride level
- Impaired fasting glucose, insulin resistance, or prediabetes.

Associated conditions

- It includes-
  - Hyperuricemia
  - Fatty liver progressing to non-alcoholic fatty liver disease
  - Polycystic ovarian syndrome in women and erectile dysfunction in men
  - Acanthosis nigricans

Diagnosis

IDF

The International Diabetes Federation consensus worldwide definition of the metabolic syndrome (2006) is: Central obesity (defined as waist circumference[#] with ethnicity-specific values) AND any two of the following:

- 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 males, < 50 mg/dL (1.29 mmol/L) in females, or specific treatment for this lipid abnormality

Contd...

- Raised blood pressure (BP): systolic BP > 130 or diastolic BP >85 mm Hg, or treatment of previously diagnosed hypertension
- Raised fasting plasma glucose (FPG): >100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes

If FPG is >5.6 mmol/L or 100 mg/dL, an oral glucose tolerance test is strongly recommended, but is not necessary to define presence of the syndrome.

If BMI is >30 kg/m², central obesity can be assumed and waist circumference does not need to be measured

WHO

- The World Health Organization 1999 criteria require the presence of any one of diabetes mellitus, impaired glucose tolerance, impaired fasting glucose or insulin resistance, AND two of the following:
- Blood pressure: ≥ 140/90 mmHg
- Dyslipidemia: triglycerides (TG): ≥ 1.695 mmol/L and high-density lipoprotein cholesterol (HDL-C) ≤ 0.9 mmol/L (male), ≤ 1.0 mmol/L (female)
- Central obesity: waist:hip ratio > 0.90 (male); > 0.85 (female), or body mass index > 30 kg/m^2
- Microalbuminuria: urinary albumin excretion ratio ≥ 20 µg/min or albumin:creatinine ratio ≥ 30 mg/g

EGIR

- The European Group for the Study of Insulin Resistance (1999) requires insulin resistance defined as the top 25% of the fasting insulin values among non-diabetic individuals AND two or more of the following:
- Central obesity: waist circumference ≥ 94 cm or 37 inches (male), ≥ 80 cm or 31.5 inches (female)
- Dyslipidemia: TG ≥ 2.0 mmol/L and/or HDL-C < 1.0 mmol/L or treated for dyslipidemia
- Hypertension: blood pressure ≥ 140/90 mmHg or antihypertensive medication
- Fasting plasma glucose ≥ 6.1 mmol/L

NCEP

- The US National Cholesterol Education Program Adult Treatment Panel III (2001) requires at least three of the following:
- Central obesity: waist circumference ≥ 102 cm or 40 inches (male), ≥ 88 cm or 35 inches(female)
- Dyslipidemia: TG ≥ 1.7 mmol/L (150 mg/dl)
- Dyslipidemia: HDL-C < 40 mg/dL (male), < 50 mg/dL (female)
- Blood pressure ≥ 130/85 mmHg (or treated for hypertension)
- Fasting plasma glucose ≥ 6.1 mmol/L (110 mg/dl)

American Heart Association

- Elevated waist circumference:
  - Men – greater than 40 inches (102 cm)
  - Women – greater than 35 inches (88 cm)
- Elevated triglycerides: Equal to or greater than 150 mg/dL (1.7 mmol/L)
- Reduced HDL ("good") cholesterol:
  - Men – Less than 40 mg/dL (1.03 mmol/L)
  - Women – Less than 50 mg/dL (1.29 mmol/L)

Contd...

- Elevated blood pressure: Equal to or greater than 130/85 mm Hg or use of medication for hypertension
- Elevated fasting glucose: Equal to or greater than 100 mg/dL (5.6 mmol/L) or use of medication for hyperglycemia

Others

- High-sensitivity C-reactive protein has been developed and used as a marker to predict coronary vascular diseases in metabolic syndrome
- It was recently used as a predictor for non-alcoholic fatty liver disease (steatohepatitis) in correlation with serum markers that indicated lipid and glucose metabolism.
- Reproductive disorders (such as polycystic ovary syndrome in women of reproductive age), and erectile dysfunction or decreased total testosterone (low testosterone-binding globulin) in men can be attributed to metabolic syndrome.

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Rheumatic diseases

- There is research that associates comorbidity with rheumatic diseases. Both psoriasis and psoriatic arthritis have been found to be associated with metabolic syndrome.

Management

- Heart-healthy lifestyle changes are the first line of treatment for metabolic syndrome.

- Medicines are used to treat and control risk factors, such as high blood pressure, high triglycerides, low HDL (good) cholesterol, and high blood sugar.

Heart-Healthy Lifestyle Changes

- Include heart-healthy eating, aiming for a healthy weight, managing stress, physical activity, and quitting smoking.

Diet

- Dietary carbohydrate restriction reduces blood glucose levels, contributes to weight loss. Low-glycemic index diet and Low salt diet helps reduce blood pressure and improves insulin sensitivity. Increased HDL cholesterol can be achieved with increase in marine omega 3 fats intake.

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Medicines

- Statin medications to control or lower the cholesterol.
- Diuretics and ACE inhibitors may be used to treat hypertension.
- Both metformin and the thiazolidinediones improve insulin resistance, but are only approved therapies for type 2 diabetes, not insulin resistance

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Weight loss drugs	Along with diet and exercise, it may be necessary to prescribe weight loss drugs. Two commonly prescribed weight-loss drugs include sibutramine (Meridia) and orlistat (Xenical).
Insulin sensitizers	In individuals with diabetes, doctors often prescribe thiazolidinediones and metformin (Glucophage, Glucophage XR) to decrease insulin resistance. These medications may also be useful in improving insulin metabolism in individuals with MS.

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Aspirin	Aspirin is often prescribed to help reduce the risk for a heart attack.
Medications to lower blood pressure	Major types of medications used to control high blood pressure include diuretics, angiotensin-converting enzymes (ACE) inhibitors, calcium channel blockers and beta blockers.
Medications to regulate cholesterol	Medications such as niacin, statins and fibrates can help improve cholesterol in the following ways: By reducing the level of low-density lipoprotein (LDL) cholesterol ("bad" cholesterol) By increasing the level of high-density (HDL) cholesterol ("good" cholesterol) By decreasing the level of triglycerides (Another "bad" component of cholesterol)

Surgery

- Recent research has shown that weight reducing surgeries like gastric banding and roux-en-ygastric bypass, bariatic surgeries can cure T2DM

Betatrophin

- Researchers at Harvard University discovered that the hormone, called betatrophin, promotes the growth of Beta cells in the pancreas in mice. The scientists found the hormone caused mice to produce these cells at 30 times the normal rate. Rather than having to take daily injections of insulin to control the amount of sugar in their blood, patients would need to take this new hormone just weekly or even monthly, according to the researchers.

Testostorone

- Testosterone replacement reverses insulin resistance in hypogonadal men with type 2 diabetes, preliminary data suggest. The findings, from a randomized trial in 81 men, were reported by Paresh Dandona, MD, PhD, head of the division of endocrinology, diabetes, and metabolism at the University of Buffalo, State University of New York. American Association of Clinical Endocrinologists 2013

Prevention

Healthy lifestyle changes can prevent the onset of the syndrome.

- These include –
  - Increased physical activity (such as walking 30 minutes every day), and
  - A healthy, reduced calorie diet.
- Many studies support the value of a healthy lifestyle. However, one study stated these potentially beneficial measures are effective in only a minority of people, primarily due to a lack of compliance with lifestyle and diet changes. The International Obesity Taskforce states that interventions on a sociopolitical level are required to reduce development of the metabolic syndrome in populations.

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- The Caerphilly Heart Disease Study followed 2,375 male subjects over 20 years and suggested the daily intake of a pint (~568 ml) of milk or equivalent dairy products more than halved the risk of metabolic syndrome.
- Some subsequent studies support the authors' findings, while others dispute them.
- A systematic review of four randomized controlled trials found that a paleolithic nutritional pattern improved three of five measurable components of the metabolic syndrome in participants with at least one of the components.

Nursing Diagnosis

- Imbalanced Nutrition: More Than Body Requirements: Intake of nutrients that exceeds metabolic needs related to Food intake that exceeds body needs, Psychosocial factors, Socioeconomic status as evidenced by Weight of 20% or more over optimum body weight; excess body fat by skinfold/other measurements
- Deficient of knowledge related to disease condition, its prevention and treatment regimen
- Activity intolerance related to Sedentary lifestyle as *evidenced by* Exertional discomfort, Abnormal blood pressure in response to activity, Verbal report of fatigue

Interventions

- Review individual cause for obesity (organic or nonorganic).
- Carry out and review daily food diary (caloric intake, types and amounts of food, eating habits).
- Formulate an eating plan with the patient, using knowledge of individual's height, body build, age, gender, and individual patterns of eating, energy, and nutrient requirements
- Emphasize the importance of avoiding fat diets.
- Weigh periodically as individually indicated, and obtain appropriate body measurements.
- Emphasize the importance of avoiding tension at mealtimes and not eating too quickly.
- Discuss restriction of salt intake and diuretic drugs if used.

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- Assess cardiopulmonary response to physical activity, including vital signs before, during, and after activity.
- Adjust activities to prevent overexertion (performing activities slowly, sitting down when brushing teeth and combing hair).
- Increase exercise/activity levels gradually and plan rest periods between activities (resting for 3 minutes in a 10-minute walk).

Exercise

- Advise patients to increase physical activity to reduce their weight and improve blood pressure.
- Encourage them to get 30 minutes of moderately intense exercise, such as walking, 5 to 7 days per week.
- Instruct them to consult a physician before starting an exercise regimen.

Smoking

- Smoking can raise the CVD risk and increase insulin resistance.
- Nicotine is highly addictive, making it hard for many people to stop smoking.
- Teach patients about the link between smoking and CVD and refer them to smoking-cessation resources.

Alcohol

- Excessive alcohol use can adversely affect cholesterol levels and cause weight gain.
- Like nicotine, alcohol is addictive. While some people can stop drinking on their own, others need medical help to manage physical withdrawal.
- Numerous resources are available for those who want to stop drinking. In most areas, Alcoholics Anonymous (AA) meetings are available, as are inpatient and outpatient treatment centers or hospitals and alcohol treatment hotlines.

References

- https://www.nhlbi.nih.gov/health-topics/metabolic-syndrome
- https://www.heart.org/en/health-topics/metabolic-syndrome/about-metabolic-syndrome
- http://nursing.advanceweb.com/metabolic-syndrome-38739/
- National Heart, Lung, and Blood Institute. What is MetabolicSyndrome
- The American Heart Association. Metabolic Syndrome
- International Diabetes Federation. IDF Worldwide Definition of the Metabolic Syndrome
- National Heart, Lung, and Blood Institute/ National Institutes of Health. What is metabolic syndrome? http://www.nhlbi.nih.gov/health/health-topics/topics/ms/
- Han TS, Lean MEJ. Metabolic syndrome. *Medicine*. 2011;39(1):24-31.
- Miranda PJ, et al. Metabolic syndrome: definition, pathophysiology and mechanisms. *Am Heart J*.2005;149(1):33-45.