# Prevalence of Metabolic Syndrome among Different Age Group Patients Presenting with Acute Myocardial Infarction

## Thesis

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# Introduction

Coronary heart disease (CHD) represents the leading cause of death in adult in the western world. Myocardial infarction (MI) is a lethal manifestation of CHD and can present as sudden death. Although MI mainly occurs in patients older than 45, young men or women can suffer MI, although with a lower incidence.However the disease carries significant morbidity, psychological effect, and financial constraint for the person and the family when it occurs at a young age. The protection offered by young age has been slowly taken away by the increased prevalence of risk factor for CHD in adolescent such as smoking, obesity and lack of physical activity. Better prognosis among young adults is achieved when the appropriate investigation and treatment are offered. The cut off age of 45 has been used in most studies to define young patients with CHD or MI ***(Sinha et al., 2002).***

Myocardial infarction in young adults is uncommon, and its characteristics may differ from those typically seen in older patients. Several reports of coronary arteriography performed in young patients after MI have demonstrated a relatively high incidence of angiography normal coronary arteries, and the prognosis of these patients is good ***(Zimmerman et al., 2005).***

Nearly 50% of young adults with premature heart disease are obese more than 80% are overweight and more than 50% have low density lipoprotein (lDL-C) levels below 130mg/dl. Recent evidence suggest that impaired glucose tolerance and

previously un diagnosed diabetes mellitus may be present in large numbers of patients with acute myocardial infarction and those undergoing angiography ***(Norhammar et al., 2002).***

The metabolic syndrome (Ms) associated with a host of traditional and emerging pro inflammatory and pro thrombotic cardiovascular (CV) risk factor. This result in a 2-4 fold increase in cv event when subject with diabetes are excluded from analysis ***(Alexander et al., 2003).***

The new international diabetes fcdcration (IDF) definition for metabolic syndrome (2005):

*Central obesity*, defined as waist equal to or more than 94 cm for males and 80 cm for females together with any two of the following:

1. Raised trigiyccrides:> 150 mg/dL (1.695mmol/L) or on specific treatment For this lipid abnormally
2. Low HDL-cholestcrol: <40 mg/dL (1.0mmol/L) in males and <50 mg/dL (1.3mmol/l)in females or on specific treatment For this lipid abnormality
3. Raiscd blood pressure: systolic BP >130 or diastolic>85 hypertension
4. Fasting blood glucose >100mg/dL (6.1mmol/L) or previous diagnosis of diabetes or impaired glucose tolerance (The IDF consensus new world definition of the metabolic syndrome 2005 **(International Diabetes Federation).**

# Aim of the Work

The aim of this work is to study the prevalence of metabolic syndrome in different age group patients presenting with acute myocardial infarction.

# Metabolic Syndrome

The Metabolic Syndrome (also known as metabolic syndrome X) is a grouping of cardiac risk factors that result from insulin resistance (when the body's tissues do not respond normally to insulin). A person with metabolic syndrome has a greatly increased risk of cardiovascular disease and premature death.

The metabolic syndrome has received increased attention in the past few years. It consists of multiple, interrelated risk factors of metabolic origin that appear to directly promote the development of atherosclerotic cardiovascular disease ***(Grundy et al., 2005).***

The terms "metabolic syndrome", "insulin resistance syndrome", and "syndrome X" are now used specifically to define a constellation of abnormalities that is associated with increased risk for the development of type 2 diabetes and atherosclerotic vascular disease (e.g. heart disease and stroke) ***(Grundy et al., 2005).***

**Risk Factors and Metabolic Syndrome:**

The most risk factors for the syndrome appear to be abdominal obesity ***(Palaniappan et al,. 1994; Carr et al., 2004)*** and insulin resistance ***(Ferrannini et al., 1991).*** Other associated conditions can be physical inactivity ***(Palaniappan et al., 1994; Gustat et al., 2002)*** aging ***(Ford et al., 2002)*** and hormonal imbalance ***(Apridonidze et al., 2004).***

An atherogenic diet (e.g., a diet rich in saturated fat and cholesterol) can enhance risk for developing cardiovascular disease in people with the syndrome, although this diet is not listed specifically as an underlying risk factor for the condition ***(NCEP, 2002).***

**Epidemiology of the metabolic syndrome:**

Epidemiological investigations have documented that the metabolic syndrome occurs commonly among middle-aged and elderly individuals, with a higher prevalence in men and among older individuals ***(Larsson et al., 1999; Expert Panel on Detection, 2001).***

Multiple metabolic clustering has been documented across a wide variety of ethnic groups with a higher prevalence among Native and Mexican Americans and Asian Indians, than among other minority groups ***(Larsson et al, 1999; Hermanussen, 1998).***

The clinical importance of the metabolic syndrome is due mainly to the increased risk imparted by the concurrent clustering of several 'independent' CVD risk factors within the same individual ***(Eriksson et al., 1997).***

- ***Etiology:***

The causes of metabolic syndrome are extremely complex and have only been partially elucidated. Most patients are older, obese and have a degree of insulin resistance ***(Nakagawa et al., 2006).***

There is debate regarding whether obesity or insulin resistance is the cause of the metabolic syndrome or a by-product of a more far-reaching metabolic derangement ***(Reiser et al., 1989).***

- ***Diagnosis:***

There are several classifications for metabolic syndrome, by the World Health Organization (WHO), International Diabetes Federation (IDF) and the National Cholesterol Education Program (NCEP), respectively.

The revised NCEP and IDF definitions of metabolic syndrome are very similar and it can be expected that they will identify many of the same individuals as having metabolic syndrome. The two differences are that IDF excludes any subject without increased waist circumference, while in the NCEP definition metabolic syndrome can be diagnosed based on other criteria and the IDF uses geography-specific cutpoints for waist circumference, while NCEP uses only one set of cutpoints for waist circumference regardless of geography.

**WHO:** the **World Health Organization** criteria require presence of diabetes mellitus and two of the following:

Blood pressure: ≥ 140/90 mmHg

Dyslipidaemia: triglycerides (TG): ≥ 1.695 mmol/L and/or 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).

**NCEP: the National Cholesterol Education Program Adult Treatment Panel III** requires at least three of the following: central obesity: waist circumference ≥ 102 cm (male), ≥ 88 cm (female)

Dyslipidaemia: TG ≥ 1.695 mmol/L

Dyslipidaemia: HDL<40 mg/dL (1.0 mmol) (male), < 50 mg/dL (1.3 mmol) (female)

Blood pressure ≥ 130/85 mmHg

Fasting plasma glucose ≥ 6.1 mmol/L

**IDF:** IDF definition of the metabolic syndrome requires central obesity plus two items as the following table show (Table 1):

**Table (1):** IDF definition of the metabolic syndrome

| **Central obesity** | | |
|---|---|---|
| **Plus any two:**<br>• *Raised triglycerides: >150 mg/dL (1.7 mmol)*<br>• *Reduced HDL- cholesterol: < 40 mg/dL (1.0 mmol) in men; < 50 mg/dL (1.3 mmol) in women*<br>• *Raised blood pressure: Systolic ≥130 mm Hg; diastolic ≥ 85 mm Hg*<br>• Raised fasting plasma glucose: Fasting plasma glucose ≥100mg/dL | | |
| **Ethnic group** | **Gender** | **Waist circumference** |
| *Europids* | *Men*<br>*Women* | *≥94 cm*<br>*≥80 cm* |
| *South Asians* | *Men*<br>*Women* | *≥90 cm*<br>*≥80 cm* |
| *Japanese* | *Men*<br>*Women* | *≥90 cm*<br>*≥85 cm* |
| *Ethnic South and Central Americans* | | *Use South Asian recommendations until more specific data are available* |
| *Eastern Mediterranean and Middle East (Arab).* | | *Use European recommendations until more specific data are available* |

Symptoms and signs:

- Fasting hyperglycemia — diabetes mellitus type 2
- High blood pressure.
- Central obesity, fat deposits mainly around the waist.
- Decreased HDL cholesterol.
- Elevated triglycerides.

## Clinical Management of the Metabolic Syndrome:

### Goals of Clinical Management:

The primary goal of clinical management in individuals with the metabolic syndrome is to reduce risk for clinical atherosclerotic disease. Even in people with the metabolic syndrome, first line therapy is directed toward the major risk factors: LDL-C above goal, hypertension, and diabetes. Prevention of type 2 diabetes mellitus is another important goal when it is not present in a person with the metabolic syndrome. For individuals with established diabetes, risk factor management must be intensified to diminish their higher risk for ASCVD. The prime emphasis in management of the metabolic syndrome is to mitigate the modifiable, underlying risk factors (obesity, physical inactivity, and atherogenic diet) through lifestyle changes. Effective lifestyle change will reduce all of the metabolic risk factors. Then, if absolute risk is high enough, consideration can be given to incorporating drug therapy to the regimen. The priority of drug therapy is elevations of LDL-C, blood pressure, and glucose; current guidelines for their management should be followed. Moreover, efforts should be made to bring about smoking cessation in any cigarette smokers ***(Grundy et al., 2005).***

**Management of the Risk Factors:**

Although many people may be genetically susceptible to the metabolic syndrome, rarely does it become clinically manifested in the absence of some degree of obesity and physical inactivity. Consequently, therapies to mitigate these underlying risk factors constitute first-line intervention. If cigarette smoking, another risk factor for ASCVD, is present, then it likewise deserves intensive cessation effort. The reason to modify underlying risk factors is to prevent or delay onset of ASCVD; and if type 2 diabetes mellitus is not already present, a concomitant goal is to prevent it as well ***(Grundy et al., 2005).***

**A) Abdominal Obesity:**

Weight reduction deserves first priority in individuals with abdominal obesity and the metabolic syndrome ***(Klein et al., 2004).***

***(I) Physical Inactivity:***

Increasing physical activity assists in weight reduction; it also has beneficial effects on metabolic risk factors; and importantly, it reduces overall ASCVD risk ***(Franklin et al., 2004)***.

Current AHA guidelines call for clinical assessment of risk for future ASCVD events before initiating a new exercise regimen. This includes a detailed history of physical activity. For high-risk patients (e.g., those with recent acute coronary

syndromes or recent revascularization), physical activity should be carried out under medical supervision, AHA guidelines further recommend exercise testing before vigorous exercise in selected patients with cardiovascular disease and other patients with symptoms or those at high risk. It is not necessary, however, that all individuals beginning an exercise program of moderate intensity that is moderately progressive undergo an exercise stress test, although this issue remains controversial ***(Thompson et al., 2003).***

***(2) Atherogenic and Diabetogenic diets:***

Beyond weight control and reduction of total calories, the diet should be low in saturated fats, trans fats, cholesterol, sodium, and simple sugars ***(NCEP, 2002).***

In addition, there should be ample intakes of fruits, vegetables, and whole grains; fish intake should be encouraged ***(Kris-Etherton et al., 2002).*** Very high carbohydrate intakes can exacerbate the dyslipidemia of the metabolic syndrome.

. ATP III recommended that for individuals entering cholesterol management the diet should contain 25% to 35% of calories as total fat ***(NCEP, 2002).***

If the fat content exceeds 35%, it is difficult to sustain the low intakes of saturated fat required to maintain a low LDL-C. On the other hand, if the fat content falls below 25%,

triglycerides can rise and HDL-C levels can declinethus, very-low-fat diets may exacerbate atherogenic dyslipidemia ***(Garg et al., 1994).***

To avoid any worsening of atherogenic dyslipidemia in patients with the metabolic syndrome, some investigators favor fat intakes in the range of 30% to 35%; others however, are concerned about possible weight gain resulting from long-term ingestion of higher fat intakes and thus prefer intakes in the range of 25% to 30%.. For many years, a low-fat diet was advocated because the high caloric density of fat could increase the likelihood of obesity. However, interest has grown in the possibility that high-protein, low-carbohydrate diets will enhance weight reduction ***(Foster et al., 2003).***

The rational seems to be that fat and protein offer satiety that is absent with carbohydrates. That this effect of fat and protein on satiety makes the diet more effective for producing weight loss is a disputable hypothesis. Moreover, research documenting that high fat/high-protein/ low-calorie diets can achieve long-term maintenance of a lower body weight is lacking. In fact, after 1 year of consumption of low-carbohydrate diets, severely obese patients show no more weight reduction than those eating a conventional weight-loss diet ***(Stern et al., 2004).***

High-fat diets not only tend to be higher in saturated fat

but they often are deficient in fruits, vegetables, and whole grains all of which are important components in currently recommended diets. High protein diets of any sort are not well tolerated by individuals with chronic renal disease who have markedly reduced glomerular filtration rate; excess protein enhances phosphorus load, which can cause acidosis and worsen insulin Resistance ***(Mitch et al., 2005).***

**B) Dyslipidemia:**

As noted before, this condition consists of abnormal levels of triglycerides and apoB, small LDL particles, and low HDL-C. According to ATP III, atherogenic dyslipidemia can become a target for lipid-lowering therapy after the goal for LDL-C has been attained. In other words, as long as LDL-C remains above goal level, LDL-C is the primary target of the therapy even in the metabolic syndrome. Other lipid risk factors are secondary. The LDL-C goals depend on estimates of absolute risk. Table (2) reviews LDL-C goals that are consistent with recommendations of ATP III ***(NCEP, 2002).***

**Table (2):** Elevated LDL-C: Primary Target of Lipid-Lowering Therapy in People at Risk for ASCVD

| Goals of Therapy | Therapeutic Recommendations |
|---|---|
| High-risk patients: <100 mg/dL (2.6 mmol/L) (for very high-risk patients in this category, optional goal <70 mg/dL) | ▪ High-risk patients: lifestyle therapies+ plus LDL-C-lowering drug to achieve recommended goal.<br>▪ If baseline LDL-C >_100mg/dL, initiate LDL-lowering drug therapy.<br>▪ If on-treatment LDL-C? 100 mg/dL, intensify LDL-lowering drug therapy (may require LDL-lowering drug combination).<br>▪ If baseline LDL-C <100 mg/dL, initiate LDL-lowering therapy based on clinical judgment (ie, assessment that patient is at very high risk) |
| Moderately high-risk patients§: <130 mg/dL (3.4 mmol/L) (for higher-risk patients; in this category; optional goal is <100 mg/dL (2.6 mmol/L) | ▪ Moderately high-risk patients: lifestyle therapies+ LD L-lowering drug if necessary to achieve recommended goal when LDL-C>130 mg/dL (3.4 mmol/L) after lifestyle therapies If baseline LDL-C is 100 to 129 mg/dL, LDL-lowering therapy can be introduced if patient's risk is assessed to be in upper ranges of this risk category |
| Moderate-riskpatients: <130mg/dL (3.4 mmol/L) | ▪ Moderate risk patients: lifestyle therapies+LDL-C lowering drug if necessary to achieve recommended goal when LDL-C ?160 mg/dL (4.1 mmol/L) after lifestyle therapies |
| Moderate-risk patients: <130mg/dL (3.4 mmol/L) | ▪ Moderate risk patients: lifestyle therapies+LDL-C lowering drug if necessary to achieve recommended goal when LDL-C? 160 mg/dL (4.1 mmol/L) after lifestyle therapies |
| Lower-risk patients: <160 mg/dL (4.9 mmol/L) | ▪ Lower-risk patients: lifestyle therapies+LDL-C lowering drug if necessary- to achieve recommended goal when LDL-C ?190 mg/dL after lifestyle therapies (for LDL-C 160 to 189 mg/dL, LDL-lowering drug is optional) |

- High-risk patients are those with established ASCVD, diabetes, or 10-year risk for coronary heart disease >20%. For cerebrovascular disease, high-risk condition includes transient ischemic attack or stroke of carotid origin or >50% carotid stenosis
- Lifestyle therapies include weight reduction, increased physical activity, and antiatherogenic diet (see Table 2 for details)
- Very high-risk patients are those who are likely to have major CVD events in next few years, and diagnosis depends on clinical assessment. Factors that may confer very high risk include recent acute coronary syndromes, and established coronary heart disease+any of following: multiple major risk factors (especially diabetes), severe and poorly controlled risk factors (especially continued cigarette smoking), and multiple risk factors of metabolic syndrome
- Moderately high-risk patients are those with 10-year risk for coronary heart disease 10% to 20%.
- Factors that can raise individuals to upper range of moderately high risk are multiple major risk factors, severe and poorly controlled risk factors (especially continued cigarette smoking), metabolic syndrome, and documented advanced subclinical atherosclerotic disease (eg, coronary calcium or carotid intimalmedial thickness >75th percentile for age and sex)