Risk Factor Assessment And Prevention For Coronary Artery Disease

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Summary

Observational studies have identified a number of patient characteristics predictive of subsequent development of coronary artery disease. Most of these risk factors are modifiable. There are now compelling evidence that modification of some of these risk factors can prevent progression and promote regression of coronary artery disease. This article reviews the evidence for the causative role of these risk factors in coronary atherosclerosis, possible preventive measures and treatment goals. (*HK Pract* 1997;19:451-465)

摘要

從日常診治中醫生已分別出部份病者的冠心病傾向，大部份引發這些傾向的因素是可改善的，現時已有一些令人信服的論點支持改變這些因素可預防冠心病的發展及促進其緩解。本文詳述這些有關引發因素及其預防與治療方法。

Introduction

In contrast to the world-wide trends of declining death rates from coronary artery disease (CAD), the mortality rate from ischaemic heart disease in Hong Kong has been climbing up steadily[1] (**Figure 1**), and CAD has always been the second killer. These facts are tragic in the sense CAD is largely preventable. A number of risk factors have been associated with the subsequent development of CAD. Many of them are modifiable[2] (**Table 1**). It has been shown that wide-spread application of proven preventive strategies can result in significant reduction of CAD mortality and morbidity. This article reviews the importance of risk factor assessment and modification for preventing CAD.

Risk factor assessment

The term risk factor is widely used to describe those characteristics found in individuals that have been

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Figure 1: Mortality rate from acute myocardial infarction and other ischaemic heart disease in Hong Kong

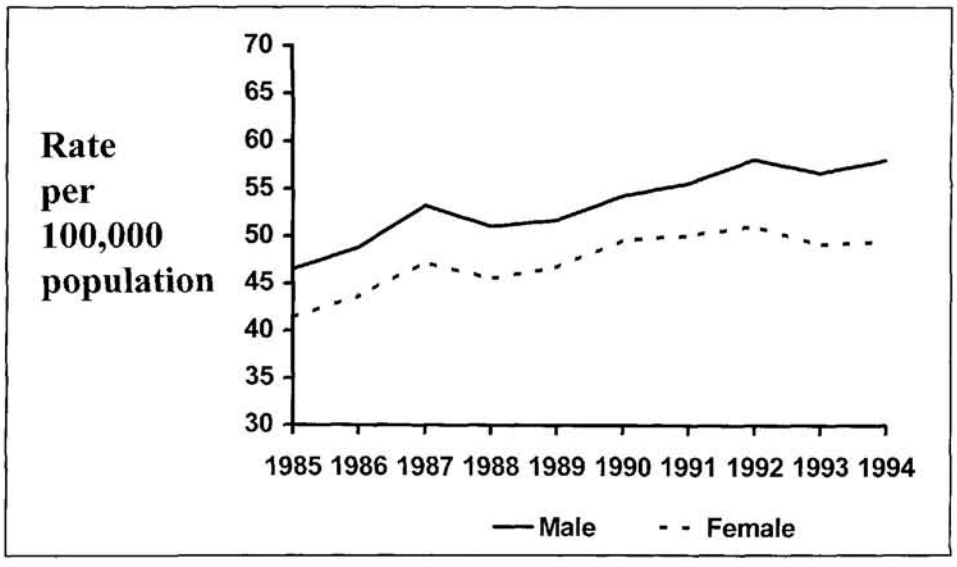

Table 1: Risk factors of coronary artery disease[2]

Lifestyle (avoidable)	Biochemical or physiological characteristics (modifiable)	Personal characteristics (non-modifiable)
• Diet high in saturated fat, cholesterol and calories • Tobacco smoking • Excess alcohol consumption • Physical inactivity	• Elevated blood pressure • Elevated plasma total cholesterol (LDL-cholesterol) • Low plasma HDL-cholesterol • Elevated plasma triglyceride • Hyperglycemia/diabetes • Obesity • Thrombogenic factors	• Age • Sex • Family history of CAD or other atherosclerotic vascular disease at early age (in men < 55 years, in women < 65 years) • Personal history of CAD or other atherosclerotic vascular disease

shown in observational epidemiological, autopsy, metabolic and genetic studies to relate to the subsequent occurrence of CAD. As mentioned by Kannel in 1976, "coronary disease does not really begin with crushing chest pain, pulmonary oedema, shock, angina or ventricular fibrillation but rather with the more subtle signs like a poor coronary risk profile".[3]

Several facts emerged from these studies. Firstly, risk factors interact synergistically, that is, in a multiplicative rather than an additive manner, to increase markedly the risk of CAD. Secondly, the presence of, and the severity of one or more risk factors, and the presence of manifest atherosclerosis dictate the aggressiveness of intervention. Thirdly, multiple risk factors interventions result in a reduction in CAD. Finally, as CAD takes time to develop, intervention should ideally begin at an early age for best effects.

In the subsequent discussion, the evidence for the causative role of the modifiable and avoidable risk factors in CAD is presented, followed by suggested interventions and then the recommended targets of therapy.

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Hypertension and left ventricular hypertrophy

Evidence

1. Epidemiological surveys indicate that the risk of CAD and cerebrovascular disease increases continuously with increasing blood pressure in both sexes.[4]

2. A meta-analysis by MacMahon and colleagues[5] of 9 prospective observational studies involving over 400,000 participants showed a strongly positive relationship between both systolic and diastolic blood pressure and CAD. The relationship was linear and without a threshold effect. It showed a relative risk compared to normotensive individuals of 3:1 at the highest pressure.

3. A meta-analysis of randomised controlled trials comprising totally 37,000 patients convincingly demonstrated that blood pressure lowering by drugs reduces the subsequent cardiovascular mortality and morbidity.[6] By maintaining a mean diastolic blood pressure difference of 5 – 6 mmHg between the treated and control groups for about 5 years, there was 14% reduction in the incidence of fatal or non-fatal CAD.

4. Benefit of treatment of hypertension in lowering CAD mortality extends to individuals aged 75 years or above.[7]

5. In the SHEP (Systolic Hypertension in the Elderly Program) Study, it was shown that treatment of isolated systolic hypertension is beneficial in reducing the incidence of cardiovascular complications including stroke, heart failure and CAD.[8]

6. Presence of left ventricular hypertrophy (LVH) is an independent risk factor for cardiovascular morbidity and mortality, particularly for acute myocardial infarction (AMI), sudden death and congestive heart failure.[9]

7. A report from the Framingham Heart Study found that subjects who demonstrated ECG regression of LVH is associated with a 25% risk reduction in cardiovascular events.[10]

Intervention

1. Non-pharmacological measures

   a) weight reduction in overweight subjects
   b) avoid excessive alcohol (not more than 10 – 30 gram/day)
   c) regular exercise
   d) reduce sodium intake to not more than 5 gm/day
   e) maintain adequate dietary intake of potassium, calcium and magnesium.

2. Drug treatment

Treatment goals of hypertension should include optimal blood pressure control and prevention of end-organ damage including LVH, renal failure, CAD and stroke. Although the early randomized trials of primary prevention of CAD in asymptomatic subjects have been conducted principally with diuretics and beta-blockers, the beneficial effects probably can be achieved with the newer anti-hypertensives. In one non-randomised study, angiotensin converting enzyme inhibitors (ACEIs) may induce a greater degree of LVH regression than beta-blockers, while the efficacy of diuretics and calcium channel blockers lie somewhere in between.[11]

Target

Benefit is documented for lowering diastolic blood pressure to between 85 to 90 mmHg. The situation is less certain for systolic blood pressure goal. An appropriate aim for systolic blood pressure is below 140mmHg in middle-aged patients and below 160 mmHg in the elderly.[12,13] In patients with documented CAD, blood pressure should not be lowered excessively which may be associated with greater cardiovascular morbidity (J-curve hypothesis).

Cigarette smoking

Evidence

There is overwhelming evidence from observational studies that cigarette smoking increases the risk of cardiovascular disease.

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1. In the British Doctors study, the overall relative risk of coronary death was shown to be about doubled, for both men and women, with a greater relative risk at a younger age.[14,15]

2. Risk increases linearly with the number of cigarettes consumed, approaching 5.5 for fatal cardiovascular events among heavy smokers.

3. Smoking magnifies the effect of other risk factors, especially the plasma cholesterol level, thereby accelerating atherosclerosis.[2]

4. Sudden cardiac death, especially in younger men, is strongly associated with smoking.[16]

5. Passive smoking is inhalation of other people's tobacco smoke. Tobacco smoke consists of sidestream smoke from the burning tip of the cigarette and mainstream smoke that has been inhaled and then exhaled by the smoker. Eighty-five percent of tobacco smoke in a room is sidestream smoke which contains a higher proportion of toxic gases. Male and female non-smokers exposed to environmental tobacco smoke (passive smoking) have a 30% increased risk of death from acute myocardial infarction or CAD.[17]

6. In the British Doctors study,[14,15] excess risk was halved within the first 2–3 years following cessation of smoking, and by 10 years the risk level had returned to that of a non-smoker. Another report,[18] however, reported a slower rate of disappearance of risk. In patients with established CAD, the risk becomes reduced within 2–3 years to the level of those CAD patients who never smoked.[19] As would be expected, the level to which the risk drops varies between individuals and depends on the amount and duration of cigarette smoking and the other risk factors present.

7. Smoking cessation is especially important in secondary prevention. In one observational study,[20] stopping smoking more than halved the number of deaths over a 13-year follow-up.

8. Continued smoking after bypass grafting is associated with a twofold increase in the relative risk of death and an increase in non-fatal myocardial infarction and angina.

Intervention

1. Simply instructing smokers to stop smoking and giving them a self-help leaflet during routine consultations by family physicians can result in a 1-year quit rate of 5%.[21]

2. One-year cessation rate increases to 19–38% with more intensive intervention, such as participation of a formal cessation program.[2]

3. Demonstration to the smoker of the level of carbon monoxide in expired breath was shown to enhance the effect of advice.[22]

4. Two large meta-analyses[23,24] have now demonstrated that nicotine replacement therapies (nicotine patch or gum) approximately double the cessation rate. The benefit is greater in those with high levels of nicotine dependence.

Target

Complete cessation.

Elevated low-density lipoprotein (LDL) cholesterol

Evidence

Numerous epidemiological studies have demonstrated a strong and graded association between total cholesterol (60–70% transported in the LDL fraction) and risk of subsequent CAD events with no threshold effect. A number of controlled trials examining the effect of cholesterol reduction on angiographic documented stenosed atherosclerotic lesions have convincingly shown that cholesterol lowering slows down the progression of these lesions and may even lead to regression in some of them.

Clinical benefit of LDL cholesterol reduction is demonstrated recently in 3 large scale prospective, randomised controlled trials:

1. West of Scotland Coronary Prevention Study[25]

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A primary prevention trial involving 6,595 middle aged men with an average baseline cholesterol of 7.0 mmol/l (mean LDL cholesterol level of 4.92 mmol/L) were recruited. After treatment with pravastatin 40 mg daily for 5 years, there was a 31% reduction in incidence of fatal and non-fatal myocardial infarction compared to those receiving placebo. All-cause mortality was also reduced by 22%.

2. Scandinavian Simvastatin Survival (4S) Study[26]

   This trial randomised 4,444 patients with a total cholesterol concentration of 5.5 – 8.0 mmol/l (mean LDL cholesterol level of 4.87 mmol/L) and angina or a previous myocardial infarction to simvastatin or placebo. Over a mean follow-up period of 5.4 years, there was a mean reduction in total cholesterol of 25%, and the relative risks of death from all causes and CAD were significantly reduced by 30% and 42%, respectively.

3. Cholesterol and Recurrent Events (CARE) Study[27]

   4,159 post-myocardial infarction patients with total cholesterol less than 6.2 mmol/l (mean LDL cholesterol level of 3.56 mmol/L) were randomised to either pravastatin or placebo. After 5 years' follow-up shows that there was a 24% reduction in the incidence of primary end-point (CAD death or non-fatal myocardial infarction). This study also documents a threshold LDL-cholesterol level for treatment (> 3.0 mmol/L).

Intervention

1. Achieve ideal body weight.
2. Encourage regular exercise.
3. Limit total fat intake to 20–30% of total energy intake. Reduce cholesterol intake to less than 300 mg/day. Cut down saturated fat consumption to less than 10% of daily total energy intake.
4. For patients with documented CAD or asymptomatic persons at high risk, drug therapy may be initiated if the above-mentioned measures fail to lower cholesterol level satisfactorily. Four classes of drugs are available – statins, resins, fibrates and nicotinic acid – each with its distinctive therapeutic profile.[28,29] Before using these medications in other subjects with lower risk of CAD, the long-term safety of the drug, compliance of the individual and cost-effectiveness of the therapy should be considered.

Target

Based on currently available data, it would be prudent to recommend a target LDL cholesterol of 2.6–3.0[27,30] mmol/l for CAD patients and 3.4–3.7[2,25,30] mmol/l for high risk asymptomatic subjects.

Reduced high-density lipoprotein (HDL) cholesterol

Evidence

1. A meta-analysis[31] of 4 major US prospective studies – Framingham Heart Study, the Coronary Primary Prevention Trial, the Lipid Research Clinics Follow-Up Study and Multiple Risk Factors Intervention Trial (MRFIT) – revealed that for each 0.025 mmol/l (1 mg/dl) decrease in HDL cholesterol level, the risk of CAD increases by 2–3%.
2. A high HDL cholesterol level appears to confer protection even when LDL cholesterol levels are relatively high. Conversely, a reduced HDL cholesterol level may be associated with CAD even when the LDL cholesterol level is in the normal range.[32]
3. Another important parameter in assessing CAD risk is the total cholesterol to HDL cholesterol ratio. A desirable ratio is below 4.5 and the optimal goal is less than 3.5.[33]
4. In patients with documented CAD, there was a markedly reduced survival rate from subsequent cardiovascular events with HDL cholesterol less than 0.9 mmol/l and a twofold increase in events compared with a baseline HDL cholesterol level exceeding 0.9 mmol/l.[34]

Intervention

1. Aerobic exercise.
2. Stop smoking.
3. Attain ideal body weight.
4. Nicotinic acid can reduce both LDL cholesterol and triglyceride while raising HDL cholesterol level. However, its use is frequently limited by side effects.
5. Most of the data on postmenopausal hormone replacement therapy are observational. Proof of its protective effect against CAD awaits prospective clinical trials, including the ongoing Women's Health Initiative. In high risk hyperlipidemic women, the use of combined oestrogen and progestin preparation may still be justified since the benefit from preventing atheromatous complication may outweigh the increased risk of cancer.[29]
6. Whether statins, fibrates and resins can reduce CAD risk by raising HDL cholesterol levels in patients with acceptable levels of LDL cholesterol is yet untested although the observed benefits with LDL cholesterol reduction from most interventional trials may have been contributed by the corresponding elevation of HDL cholesterol.
7. The consumers of 10–30 g of ethanol daily (1–3 glasses of wine or 1–3 bottles of beer) will experience on average a 0.15 to 0.18 mmol/l increase in HDL cholesterol.[35] However, it is well established that levels of alcohol consumption above the recommended values are associated with increased CAD morbidity and mortality. For this reason, current guidelines do not recommend alcohol as a means of reducing CAD risk.

Target

It is desirable to maintain HDL cholesterol level not less than 1 mmol/l in men and not less than 1.1 mmol/l in women while keeping the total cholesterol to HDL-cholesterol ratio between 3.5 to 4.5.

Elevated triglyceride (TG)

Evidence

The relationship between TG and CAD remains controversial. TG level tends to vary inversely with HDL cholesterol level. Thus, the effect of TG diminishes or disappears when HDL cholesterol level is taken into consideration. Some studies, however, have provided compelling evidence for TG as an independent predictor of CAD.

1. The Lipid Research Clinics Follow-Up Study reported a twofold increased mortality with moderate TG elevations (2.25–4.5 mmol/l) and a 3.5 fold excess death rate with high TG (over 4.5 mmol/l) in women aged between 50 to 69 years.
2. In many individuals, elevated TG levels reflect an underlying disorder of triglyceride rich lipoproteins, very low density lipoprotein (VLDL) and intermediate density lipoprotein (IDL) and is associated with an increased production of particularly atherogenic small, dense LDL particles. Not surprisingly, retrospective analyses of several angiographic trials[36,37] suggest that baseline levels of TG, IDL and small, dense LDL are better predictors of outcome than the LDL cholesterol level. Benefit of cholesterol lowering therapy mostly occurred in patients with high TG, increased IDL and small, dense LDL particles despite similar degree of LDL cholesterol reduction.
3. Studies in diabetics have also demonstrated the importance of TG in CAD as evidenced by the 11-year follow-up of the Paris Prospective Study[38] where TG was the sole predictor of CAD death after adjustment for all other risk factors.

Intervention

1. Achieve ideal body weight.
2. Alcohol restriction.
3. Physical exercise can reduce TG by activating lipoprotein lipase.
4. Stop smoking since it is associated with 10% elevation in TG.

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5. Reduce fat intake

   Saturated fat should constitute less than 7% of total calorie intake. Inappropriately high energy intake in the form of fat will cause body tissues such as adipose tissue and skeletal muscle to become resistant to hormones like insulin. This will lead to raised TG, low HDL cholesterol and increased small, dense LDL particles.

6. Omega-3 fatty acids present in certain cold-water fish can lower TG by around 30–50%. Consuming such fish regularly is encouraged provided that the ideal body weight is not exceeded. In view of potential side effects like gastrointestinal upset and weight gain, fish oil capsules are usually reserved for exceedingly high TG levels (over 11 mmol/l). Obviously, treatment is indicated in the presence of complicating pancreatitis.

7. Drug treatment with fibrates or nicotinic acid may be appropriate in high risk patients (patients with established CAD, concomitant hypercholesterolaemia or familial combined hyperlipidaemia) if TG is above 2.3 mmol/l. The threshold for drug therapy will also be lowered in the presence of low HDL cholesterol and/or a total cholesterol to HDL-cholesterol ratio of 5 or more.

Target

Maintain TG level below 2.3 mmol/l.

Diabetes mellitus

Evidence

1. In patients with non-insulin dependent diabetes mellitus (NIDDM), coronary mortality is increased two times in male and four times in female patients.[39]

2. Coronary mortality is increased threefold to tenfold in patients with Type I insulin dependent diabetes mellitus (IDDM) compared with that in age-matched non-diabetic control subjects.[40]

3. Diabetes mellitus is associated with decreases in HDL cholesterol and increases in VLDL and triglyceride. Women with diabetes mellitus completely lose their gender-related protection from CAD.

4. High insulin concentrations, whether due to exogenous insulin in IDDM patients or peripheral insulin resistance in NIDDM patients, have been shown to be associated with CAD independent of other risk factors.

5. Patients with diabetes had a 57% increase in risk of death even after bypass surgery according to follow-up data from the Coronary Artery Surgery Study (CASS). It remains a poor prognostic factor in patients with established CAD.

Intervention

1. Weight loss in obese DM patients will improve insulin sensitivity and lowers triglyceride levels.

2. Physical exercise will decrease hyperinsulinaemia by reducing insulin resistance.

3. A diet low in total fat (less than 30% of calories), saturated fat (less than 10%), and cholesterol (less than 300 mg/day) is recommended. Mono-unsaturated fat predominance has replaced the high fat and protein recommendations of the past.

4. Maximize drug therapy.

Target

In the Diabetes Control and Complications Trial (DCCT),[41] intensive therapy resulted in decreased incidence of microvascular complications (retinopathy, microalbuminuria and neuropathy). There is a trend towards reduced macrovascular complications but it is not statistically significant. The role of glucose control in preventing CAD in NIDDM patients is untested yet. The ongoing UK Prospective Diabetes Study may shed some light on this issue and results should be available in 1998.

Physical inactivity

Evidence

1. Various observational studies have found that lack of physical activity is associated with approximately twice the risk of dying from CAD.[42]

2. There is a strong inverse association between the risk of an initial myocardial infarction and physical activity, independent of other coronary risk factors. A 69% reduction in risk-adjusted myocardial infarction rate has been demonstrated in subjects exercising more than 2.2 hours per week, compared with inactive individuals.[43]

3. Atherosclerotic disease regression in a degree similar to that observed in lipid lowering trials has been demonstrated by quantitative angiogram after intense aerobic exercise training.[44]

4. A meta-analysis[45] of 22 randomised trials involving nearly 4,600 patients clearly showed the benefit of cardiac rehabilitation after myocardial infarction. Among those assigned to an exercise program, there were significant reductions in reinfarction rate (25%), cardiovascular mortality (22%) and total mortality (20%).

Intervention

1. Physical activity should be part of a health promotion and disease prevention program. Individuals should be encouraged to engage in activities requiring up to 2,000 Kcal/week for maximum health benefits.[46] Walking 20 miles every week is one way to accomplish this goal. The same recommendations are made for both men and women but more research is needed for women.

2. Exercise need not be of high intensity to be beneficial. The total amount is more important for health than high-intensity exercise.

3. It is advisable to perform an exercise test before recommending an exercise program to an asymptomatic sedentary person above 40 years of age, particularly if his or her total CAD risk estimate is high.

4. Exercise recommendations in patients with established CAD have to be made only after comprehensive clinical assessment for which the results of an exercise stress testing provide important information on safety limit.

5. High risk patients (those recovering from acute myocardial infarction, coronary artery bypass surgery or angioplasty) will need an organized rehabilitation program with exercise training performed under continuous electrocardiographic monitoring.

Target

1. Healthy individuals should aim at consuming 2,000 Kcal every week through exercise.

2. In patients with CAD, a progressive and monitored exercise training program is recommended. Maximal heart rate should be at least 10 beats per minute below the heart rate associated with electrocardiographic or clinical evidence of ischaemia during an exercise stress test.[46]

Thrombogenic factors

Evidence

1. Increased CAD has been associated with:

   a) raised levels of fibrinogen, von Willebrand factor, Factor VIIc and homocysteine

   b) increased platelet count and platelet aggregability

   c) decreased tissue type plasminogen activator

   d) elevated concentration of lipoprotein(a); a lipoprotein with antifibrinolytic activity.

2. The value of anti-platelet therapy in secondary prevention was documented in an extensive meta-analysis by the Anti-platelet Trialists' Collaboration.[47] Overall there was a 25% reduction in the incidence of a subsequent vascular event. No difference was noted between higher (500–1500 mg/day) and lower doses (75–325 mg/day) or between aspirin monotherapy and adjunctive use of sulfinpyrazone or dipyridamole.

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3. The value of aspirin for primary prevention is controversial. Results from the two largest studies[48,49] raised much debate. In general, chronic aspirin administration appears to have some benefits for healthy men at higher cardiovascular risk, including those over 50, but appears to be of limited benefit for healthy low-risk subjects.

Intervention

1. Exercise, smoking cessation can lower fibrinogen level.

2. The use of oestrogen and reduced saturated fat intake can lower Factor VIIc.

3. Prescribe aspirin to all patients with CAD unless contraindicated.

Post-menopausal state

Evidence

1. Incidence rates of CAD are substantially higher in men than in women before the menopause, at which point the sex differential begins to diminish.[50]

2. Among women with premature menopause, higher rates of CAD are seen compared with pre-menopausal women of the same age.[51]

3. With the minimum daily dose of conjugated equine oestrogens or human oestrogens recommended for prevention of bone loss, there would be a decrease in LDL cholesterol of between 4 and 10% and an increase in HDL cholesterol of around 10 to 15%.[52] Recently, oestrogen associated calcium antagonist effects, direct actions of oestrogen on the vessel walls and oestrogen associated antioxidant effects have been reported.[53] These could all offer protection against atherosclerosis.

4. Observation studies suggest that oestrogen replacement in post-menopausal women results in a 50% reduction in the risk of developing CAD.[54] These studies, however, have been criticized[55] for not adequately controlled for biases in selecting women for treatment.

Intervention

Despite the attractive biochemical changes induced by oestrogen use, clinical efficacy of post-menopausal hormone replacement is still controversial. Worries are still present concerning whether addition of progestins in combination therapy may negate the beneficial effects of oestrogen[56] and also whether incidence of breast cancer will be increased in the long run. Nevertheless, it may still be indicated in women at high risk of CAD, especially if there is concomitant hyperlipidaemia.[57]

Obesity

Evidence

1. Increased body mass index (BMI) has been shown to be associated with reduced insulin sensitivity, increased risk of NIDDM,[58] raised triglyceride and total cholesterol levels, low HDL cholesterol level[59] and increased blood pressure.[12]

2. Cohort studies have demonstrated that obesity is associated with increased risk of CAD.[60,61]

3. Central obesity is associated with insulin resistance and hypertension. It confers greater risk of CAD than peripherally distributed fat. Males and females with a waist: hip ratio of over 1.0 and 0.8 respectively are considered most at risk.[62]

Intervention

Lose weight by reducing energy intake and/or increasing energy expenditure.

1. Reduce energy intake

   a) Dietary

      Take a diet with a daily energy deficit of between 500 and 1000 Kcal.

   b) Pharmacotherapy, e.g. appetite suppressants, thermogenic agents, bulking agents, may be tried, although the long term efficacy of these treatment modalities and their safety are unproved.

   c) Procedural interventions, (e.g. gastric balloon, waist cord, jaw wiring, liposuction) and other

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Key messages

Risk factor intervention	Target	Recommendations
Hypertension	< 140/90 mmHg (middle-aged persons) < 160/90 mmHg (elderly subjects)	Lifestyle modification – weight control, physical activity, alcohol moderation and sodium restriction Add anti-hypertensive medication if BP is still high despite above-mentioned measures
Cigarette Smoking	Complete cessation	Strongly encourage patient and family members to stop smoking Provide nicotine replacement therapy and formal cessation program if needed
Elevated Low-Density Lipoprotein Cholesterol	< 2.6–3.0 mmol/L for patients withCAD < 3.4–3.7 mmol/L in high risk asymptomatic individuals	Initiate lifestyle change – ideal body weight, regular physical exercise, dietary restriction Cholesterol lowering drug
Low High-Density Lipoprotein Cholesterol	> 1.0mmol/L in men > 1.1mmol/L in women Keep HDL-cholesterol to total cholesterol ratio between 3.5–4.5	Lifestyle change – ideal body weight, aerobic exercise and stop smoking Individual consideration for hormonal replacement therapy and treatment with statins, fibrates, nicotinic acid or resins
Elevated Triglyceride	< 2.3 mmol/L	Lifestyle modification – ideal body weight, alcohol restriction, regular exercise, reduces fat intake, stop smoking Omega-3 fatty acid, fibrates and nicotinic acid therapy in selected high risk patients
Diabetes Mellitus	Good blood glucose control (evidence pending)	Weight loss for obese patients Regular exercise Low fat and cholesterol diet Optimise insulin or oral hypoglycemic drug therapy
Physical Inactivity	Consume 2000 Kcal/week through aerobic exercise in healthy individuals Regular exercise (at least 30–40 minutes, 3–4 times weekly) with intensity guided by exercise ECG test in established CAD patients	Encourage performing aerobic exercise Increase in daily lifestyle activities (e.g. using stairs, household work)
Thrombogenic Factors		Lifestyle change – regular exercise, stop smoking, reduce saturated fat intake Aspirin for all CAD patients unless contraindicated Oestrogen therapy in post-menopausal women (individual consideration)
Post-Menopausal State		Combined oestrogen-progestogen hormonal replacement therapy (individual consideration)
Obesity	Body Mass Index between 20–24.9 kg/m^2 Waist to hip ratio < 0.9 in men and < 0.8 in women	Weight loss by reducing calorie intake and increasing energy expenditure through exercise Pharmacotherapy and surgical methods in morbid obesity patients

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surgical interventions (e.g. gastroplasty, gastric bypass, ileal bypass) should be reserved for morbid obesity patients.

2. Increase energy expenditure through exercise

   Diet restriction must be accompanied by increasing exercise for best effects.

Target

1. The optimal rate of weight loss is between 0.5 and 1.0 Kg/ week. A more rapid weight loss is undesirable due to accompanying breakdown of lean body mass.

2. Aim at a body mass index between 20 to 24.9 Kg/m^2.

3. The desirable waist to hip ratio is less than 0.9 for men and 0.8 for middle-aged women.[62,63]

Conclusion

While we are putting a lot of resource on expensive, technologically advanced therapies of CAD, we should not forget that preventing CAD from the very beginning may be much more cost-effective. Except for some personal/ familial characteristics, most risk factors for CAD are either modifiable or avoidable. In contemplating CAD prevention in any particular person, effort should be directed to various mentioned risk factors in a comprehensive manner. Modest reductions in multiple risk factors are likely to reduce risk more than aggressive reduction of a single risk factor while ignoring the others. ■

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