

CORONARY HEART DISEASE RISK ASSESSMENT

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CONCEPT OF RISK FACTOR ASSESSMENT

Coronary heart disease is the second major killer in Singapore. As such there is much to be gained in the assessment of patients who are potential heart disease patients. Over the past decade, much has been learnt about the pathophysiology of coronary artery disease (CAD). We now know that angina, unstable angina and infarction are a continuous spectrum of disease involving the atherosclerotic plaque and the changes it undergoes. On the one end of the spectrum, we have the stable plaque, which comprises a fibrous cap, lipid core and smooth muscle media. These plaques do not cause problems unless the demand for oxygen outstrips the blood supply. On the other hand when the plaque becomes unstable it is liable to crack and cause platelet activation and aggregation and activation of the coagulation cascade thus causing occlusion of the artery and causing ischemia, which if left unchecked can cause infarction.

It has also become clear with new studies showing that proper methods to try and stabilize or pacify the plaque can reduce the incidence of unstable plaques occurring.

In the management of patients with CAD early identification and management of the cardiac risk factors will have an effect on reducing the progression of atherosclerotic disease and in some cases stabilizing the plaque.

MAJOR CORONARY HEART DISEASE RISK FACTORS

Risk factors for CAD are divided into modifiable and non-modifiable risk factors:

Modifiable risk factors

- κ Hypertension
- κ Diabetes Mellitus
- κ Hyperlipidemia
- κ Smoking

Non-modifiable risk factors

- κ Age
- κ Sex – males have 3-4 times higher risk
- κ Race-Indians in particular having a higher incidence of CAD
- κ Family history of CAD
- κ Personality type

The other risk factors which are not the common risk factors included above like elevated homocysteine levels, elevated Lp (a), elevated fibrinogen and C-reactive protein levels, waist – hip ratio, BMI.

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Modifiable risk factors

Hypertension

This risk factor has been shown early on to be associated with increased risk for CAD. Elevated levels of blood pressure have been shown to increase shear force in the arterial wall and promote plaque formation as well as destabilization of the plaque.

In the evaluation of the hypertensive patient it is important to distinguish the type of hypertension either primary or secondary and whether there are any concomitant target organs involvement and to evaluate lifestyle and identify cardiovascular risk factors or concomitant disorders that may affect prognosis and guide treatment (Table 1).

Table 1: Cardiovascular Risk Factors

Major Risk Factors

Hypertension*
Cigarette smoking
Obesity (BMI ≥ 30)*
Physical inactivity
Dyslipidemia*
Diabetes mellitus*
Microalbuminuria or estimated GFR ≤ 60 mL/min
Age (L 55 years for men, L 65 years for women)

Target-Organ Damage

Heart – left ventricular hypertrophy; angina or prior myocardial infarction; prior coronary revascularization; heart failure
Brain – stroke or transient ischemic attack; chronic kidney disease; peripheral arterial disease; retinopathy

* Components of the metabolic syndrome

Source: JNC VII, 2003

There are a number of major guidelines published over the past few years by a number of international bodies to try and define BP levels and targets as well as provided a guide for management. Notably the 3 major international bodies on BP control are:

- κ The JNC VII committee on BP
- κ The European society of Hypertension guidelines
- κ The WHO/ISH guidelines on BP

In keeping with the latest JNC VII criteria patients are divided into:

- κ Normal BP $\leq 120/80$
- κ Pre-Hypertension BP 120–139 systolic or diastolic 80–89
- κ Stage 1 Hypertension BP 140–159 systolic or diastolic 90–99
- κ Stage 2 Hypertension BP ≥ 160 systolic or diastolic ≥ 100 .

In JNC VII patients above the prehypertension range have to be treated with antihypertensive medications or if they have any of the compelling indications to start a particular antihypertensive therapy i.e. h/o heart failure, post AMI, high CAD risk, DM, chronic kidney disease, recurrent CVA.

In the European Society of hypertension guidelines for hypertension there is a similar classification with the WHO/ISH guidelines of Blood pressure levels:

| | | |
|-------------|--------------|--------------|
| Optimal | 120 Systolic | 80 Diastolic |
| Normal | 120–129 | 70–84 |
| High normal | 130–139 | 85–89 |
| Gd 1 Hypt. | 140–159 | 90–99 |
| Gd 2 Hypt. | 150–179 | 100–109 |
| Gd 3 Hypt | 180 | 110 |

However the European guidelines prefer to reserve the definition of hypertension based on the global risk profile of the patient rather than on a fixed value.

In Singapore the ministry of health published its guidelines on hypertension management in June 2000 and it was mainly in keeping with WHO/ISH guidelines which state that the target goals for BP control are BP 130/85 in young adults, middle aged and diabetic patients and BP 140/90 in elderly patients. These Guidelines may be reviewed soon in the light of the recently published JNC VII and ESH guidelines

In general the aim of good BP control is to reduce the onset and complications of CAD and stroke.

Hyperlipidemia

As with Hypertension hyperlipidemia constitutes an important risk factor in CAD. As with hypertension the management of hyperlipidemia has had a number of expert panel reports notably the National Cholesterol Education Program (NCEP) guidelines and recently the Ministry of Health published its own guidelines in July 2001. In general patients are classified according to their cardiovascular risk factors as well as their estimate of the 10-year risk of developing CAD based on the Framingham point scores. See Tables 2A & 2b taken from NCEP III.

The key points of the NCEP III panel were that in addition to treating patients with known CAD aggressively, the assessment of absolute risk of developing CAD during a 10 year period is given extra importance. Patients with absolute 10 year risk of $\leq 20\%$ of developing CAD are considered candidates for very aggressive therapy (LDL-C goal of $\leq 100\text{mg/dl}$). In patients with absolute 10-year risk of 10-20% less aggressive therapy is needed to target levels of LDL-C of $\leq 130\text{mg/dl}$.

Depending on the category they fall into they will require management with either dietary modification/lifestyle changes alone or with drug therapy and to aim to maintain their target values.

However in the patients who have CAD, DM or the metabolic syndrome, drug therapy has to be instituted early

Table 2a: Estimate of 10-Year CHD Risk for Men (Framingham Point Scores)

| Framingham Point Scores by Age Group | |
|--------------------------------------|--------|
| Age | Points |
| 20–34 | - 9 |
| 35–39 | - 4 |
| 40–44 | 0 |
| 45–49 | 3 |
| 50–54 | 6 |
| 55–59 | 8 |
| 60–64 | 10 |
| 65–69 | 11 |
| 70–74 | 12 |
| 75–79 | 13 |

Framingham Point Scores by Age Group and Total Cholesterol

| Total Cholesterol | Age (years) | | | | |
|-------------------|-------------|-------|-------|-------|-------|
| | 20-39 | 40-49 | 50-59 | 60-69 | 70-79 |
| ≤ 160 | 0 | 0 | 0 | 0 | 0 |
| 160–199 | 4 | 3 | 2 | 1 | 0 |
| 200–239 | 7 | 5 | 3 | 1 | 0 |
| 240–279 | 9 | 6 | 4 | 2 | 1 |
| 280+ | 11 | 8 | 5 | 3 | 1 |

Framingham Point Scores by Age Group and Smoking Status

| | Age (years) | | | | |
|-----------|-------------|-------|-------|-------|-------|
| | 20-39 | 40-49 | 50-59 | 60-69 | 70-79 |
| Nonsmoker | 0 | 0 | 0 | 0 | 0 |
| Smoker | 8 | 5 | 3 | 1 | 1 |

Framingham Point Scores by HDL Level

| HDL | Points |
|-----------|--------|
| 60+ | - 1 |
| 50–59 | 0 |
| 40–49 | 1 |
| ≤ 40 | 2 |

Framingham Point Scores by Systolic Blood Pressure and Treatment Status

| Systolic BP | If Untreated | If Treated |
|-------------|--------------|------------|
| ≤ 120 | 0 | 0 |
| 120–129 | 0 | 1 |
| 130–139 | 1 | 2 |
| 140–159 | 1 | 2 |
| 160+ | 2 | 3 |

10-Year Risk by Total Framingham Point Scores

| Point Total | 10-Year Risk |
|-------------|--------------|
| ≤ 0 | $\leq 1\%$ |
| 0 | 1% |
| 1 | 1% |
| 2 | 1% |
| 4 | 1% |
| 5 | 2% |
| 6 | 2% |
| 7 | 3% |
| 8 | 4% |
| 9 | 5% |
| 10 | 6% |
| 11 | 8% |
| 12 | 10% |
| 13 | 12% |
| 14 | 16% |
| 15 | 20% |
| 16 | 25% |
| ≥ 17 | $\geq 30\%$ |

Table 2b: Estimate of 10-Year CHD Risk for Women (Framingham Point Scores)

| Framingham Point Scores by Age Group | |
|--------------------------------------|--------|
| Age | Points |
| 20-34 | - 7 |
| 35-39 | - 3 |
| 40-44 | 0 |
| 45-49 | 3 |
| 50-54 | 6 |
| 55-59 | 8 |
| 60-64 | 10 |
| 65-69 | 12 |
| 70-74 | 14 |
| 75-79 | 16 |

Framingham Point Scores by Age Group and Total Cholesterol

| Total Cholesterol | Age (years) | | | | |
|-------------------|-------------|-------|-------|-------|-------|
| | 20-39 | 40-49 | 50-59 | 60-69 | 70-79 |
| I 160 | 0 | 0 | 0 | 0 | 0 |
| 160-199 | 4 | 3 | 2 | 1 | 1 |
| 200-239 | 8 | 6 | 4 | 2 | 1 |
| 240-279 | 11 | 8 | 5 | 3 | 2 |
| 280+ | 13 | 10 | 7 | 4 | 2 |

Framingham Point Scores by Age Group and Smoking Status

| | Age (years) | | | | |
|-----------|-------------|-------|-------|-------|-------|
| | 20-39 | 40-49 | 50-59 | 60-69 | 70-79 |
| Nonsmoker | 0 | 0 | 0 | 0 | 0 |
| Smoker | 9 | 7 | 4 | 2 | 1 |

Framingham Point Scores by HDL Level

| HDL | Points |
|-------|--------|
| 60+ | - 1 |
| 50-59 | 0 |
| 40-49 | 1 |
| I 40 | 2 |

Framingham Point Scores by Systolic Blood Pressure and Treatment Status

| Systolic BP | If Untreated | If Treated |
|-------------|--------------|------------|
| I 120 | 0 | 0 |
| 120-129 | 1 | 3 |
| 130-139 | 2 | 4 |
| 140-159 | 3 | 5 |
| 160+ | 4 | 6 |

10-Year Risk by Total Framingham Point Scores

| Point Total | 10-Year Risk |
|-------------|--------------|
| I 9 | I 1% |
| 9 | 1% |
| 10 | 1% |
| 11 | 1% |
| 12 | 1% |
| 13 | 2% |
| 14 | 2% |
| 15 | 3% |
| 16 | 4% |
| 17 | 5% |
| 18 | 6% |
| 19 | 8% |
| 20 | 11% |
| 21 | 14% |
| 22 | 17% |
| 23 | 22% |
| 24 | 27% |
| 25+ | O 30% |

together with tight target levels achieved and maintained. The target values to aim for in the various categories of patients are given in Tables 3, 4 and 5.

Table 3: Classification of Total, LDL-C, HDL-C and triglyceride Levels

| Total Cholesterol (mmol/L [mg/dL]) | |
|------------------------------------|-----------------|
| I 5.2 (200) | Desirable |
| 5.2-6.1 (200-239) | Borderline high |
| O 6.2 (240) | High |
| LDL Cholesterol (mmol/L [mg/dL]) | |
| I 2.6 (100) | Optimal |
| 2.6-3.3 (100-129) | Desirable |
| 3.4-4.0 (130-159) | Borderline high |
| 4.1-4.8 (160-189) | High |
| O 4.9 (190) | Very high |
| HDL Cholesterol (mmol/L [mg/dL]) | |
| I 1.0 (40) | Low |
| 1.0-1.5 (40-59) | Desirable |
| O 1.6 (60) | High |
| HDL (mmol/L [mg/dL]) | |
| I 1.7 (150) | Optimal |
| 1.7-2.2 (150-199) | Desirable |
| 2.3-4.4 (200-399) | High |
| O 4.5 (400) | Very high |

Source: MOH CPG Lipids, 2001

Table 4: Major risk Factors (Excluding LDL-C) that modify LDL-C treatment goals

- O Cigarette smoking
- O Hypertension (BP O 140/90 mmHg or on anti-hypertensive medication)
- O Low HDL cholesterol (I 1.0 mmol/L [40 mg/dL])
- O Family history of premature CHD (CHD in male first degree relative I 55 years; CHD in female first degree relative I 65 years)
- O Age (men O 45 years; women O 55 years)

Table 5: LDL-C Cholesterol Goals and Cut-off points for Therapeutic Lifestyle Changes (TLC) and Drug Therapy in the 3 Risk Group Categories

| | LDL Goal (mg/dL) | LDL Level at Which to Initiate Therapeutic Lifestyle Changes (TLC) (mg/dL) | LDL Level at Which to Initiate Consider Drug Therapy (mg/dL) |
|--|------------------|--|--|
| CHD or CHD Risk Equivalents (10-year risk L 20%) | I 100 | O 100 | O 130 (100-129; drug optional) |
| 2 + Risk Factors (10-year risk m 20%) | I 130 | O 130 | 10-year risk 10-20% O 130 |
| 0-1 Risk Factor | I 160 | O 160 | O 190 (160-189 LDL lowering drug optional) |

Diabetes Mellitus

Much can be said about diabetes mellitus. It is now regarded as a CAD equivalent. With all its associated target organ damage and associated cardiac risk factors, the tight control of DM is crucial in preventing development of end organ damage as well as progression of atherosclerotic disease. More of this will be discussed during the lectures on Diabetes.

Smoking

It goes without saying that this is truly a modifiable risk factor and has to the patient the dangers of smoking in the development of CAD.

ASSESSMENT OF A PATIENT'S OVERALL RISK FOR CORONARY ARTERY DISEASE

In the assessment of the patient for coronary artery diseases it is important to evaluate for the risk factors of CAD. Thus aside from a good history taking of the presentation of the symptoms and a careful history of the CAD risk factors both modifiable and non-modifiable need to be taken. In addition when performing investigations to rule out CAD one needs to do tests to evaluate for these concomitant CAD risk factors. This has an important part to play in the management of the CAD patient.

In situations where the history of the presenting complaint sounds atypical for CAD it is important to weigh the risk factors the patient has for CAD. If the patient has risk factors for CAD then one must consider the possibility of CAD even though the history may not always be typical for CAD.

In the end, the final assessment of a patient's overall risk for CAD depends upon the clinical presentation together with the presence of CAD risk factors.

LEARNING POINTS

- In the assessment of the patient for coronary artery diseases it is important to evaluate for the risk factors of CAD. Thus aside from a good history taking of the presentation of the symptoms and a careful history of the CAD risk factors both modifiable and non-modifiable need to be taken
- In addition when performing investigations to rule out CAD one needs to do tests to evaluate for these concomitant CAD risk factors. This has an important part to play in the management of the CAD patient
- The final assessment of a patient's overall risk for CAD depends upon the clinical presentation together with the presence of CAD risk factors. An estimate of 10-Year CHD Risk can be calculated using the Framingham Point Scores
- The LDL Cholesterol goal for the individual can be set using the Framingham Point Scores.

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