What is the Role of Carotid Intimal Media Thickness (CIMT) in the Management of Atherosclerosis?

Dr. Chun-ho Cheng  
MBBS (HK), MRCP (UK), FRCP (Edin.), FRCP (Lond.), FHKAM (Medicine) FHKCP, Specialist in Cardiology

Dr. Yik-hon Cheng  
MBBS (UK), BSc (Hons.), MRCP (UK)  
Division of Cardiology, Queen Elizabeth Hospital, Hong Kong

It appeared in the recent newspaper, a 53 year old gentleman developed sudden cardiac arrest in a gymnasium during his routine work-out on a treadmill. According to the information provided, he was engaged in regular exercise programmes and underwent annual check-up. Even though the cause of his sudden death was not published, it was likely due to either cerebral or cardiac causes.

Routine screening can pick up significant stenotic lesion but it cannot prevent myocardial infarction. Increase plasma LDL cholesterol (LDL-C) may injure endothelial cells. Endothelial cell injury would subsequently lead to plaque formation which reduces lumen size and limit blood flow. Rupture of atherosclerotic plaque can be triggered by stress or exercising. The pre-ruptured plaque itself may not cause significant stenosis (lumen size 40%-60%) prior to the acute episode.

I would like to discuss several cases to illustrate our clinical decision.

Case No.1: Case No.1: A 57 years old gentleman suffers from hyperlipidaemia. He is also a hepatitis B carrier. During his annual check-up, his LDL-C was found to be 4.5 mmol/l. Routine exercise showed 1.5mm ST depression on his lateral chest leads. Myocardial perfusion scan performed which showed no evidence of reversible perfusion abnormality. His carotid intimal thickness study by ultrasound showed significant patchy thickening on both sides (1.3mm to 1.4mm). Based on these finding, he was advised to receive statin and aspirin treatment.

He turned down my offer and promised to come back for assessment six months later. He came back after two months and revealed that he has suffered from a heart attack during his trip to Toronto and required urgent angioplasty and stenting. Currently, he is maintained on high dose of statin, aspirin and plavix. The case illustrates that dietary changes can reduce the LDL-C dramatically.

Nevertheless, one has to bear in mind that these changes can only be observed in certain subset of individuals.

The POSCH (Program on the Surgical Control of Hyperlipidaemia) study demonstrated that ileal bypass surgery can reduce the LDL-C by 38% and the CHD-Mortality by 39%.

Case No.3: A 65 years old gentleman who is a chronic smoker. He sustained a minor cerebellar infarct two years ago. Investigation showed his LDL-C was 3.8 mmol/l and HDL-C was 1.2 mmol/l. With statin therapy, his LDL-C has reduced to 1.8 mmol/l, but he continues to smoke. The CIMT showed definite progression despite a relative low LDL-C level. This case has highlighted the importance of total risk management.

Cigar or cigarette smoking is one of the most important risks factors which can dilute or nullify the effect of lipid lowering drugs. The manufacturer or cigar shop has lured the middle or rich segment of our society that they are not inhaling the cigar smoke. The cigar smoke "only stays" in the upper airway. This "hypothesis" is well accepted by the rich segment of the society as they believe that it causes no risk to their cardiovascular system.

Apart from low fat diet, we should pay attention to unsaturated fats (both polyunsaturated and monounsaturated fats) which will lower the total cholesterol and LDL-C. Olive oil and peanut oils contain mainly monounsaturated fats. Excessive polyunsaturated fats may be associated with decrease in good cholesterol (HDL-C). Trans-fats are found in the food manufacturing process during which the product is hydrogenated to change oil from liquid to solid. This process can lengthen the shelf life and enhance the taste. Trans-fats are however detrimental to cardiac health.
because they increase bad cholesterol, decrease good cholesterol and affect the essential fatty acids metabolism. Consumers are reminded of reading the labels when choosing packaged foods, and be aware of the names like hydrogenated oil, partially hydrogenated oil, shortening, etc. There is also a small amount of trans fat naturally found in animal meats as well as dairy products.

Despite the wide spread prescription of lipid lowering drug, only 51% of the patients on lipid lowering therapy achieved goal as in the Eurospire II study. In the NCEP ATP III, they have set different targets for different individuals with risk factors. The LDL-C target is 4.1mmol/l for individuals with less than 2 risk factors and this level is lowered to 1.8mmol/l for high risk individuals. I personally think that these guidelines will be changed as the CIMT provides a visual image of atherosclerosis. It may become the future tool for diagnosis and treatment of cardiovascular risk.

CIMT is able to help the clinician to make the following decision:

(i) When to start treatment.
(ii) The need for further adjustment.
(iii) The need to look for other risk factors. (e.g. Homocysteine, Lp(a))

The visual image recorded also enhances patient’s compliance.

Why are patients on statin still at risk? The following are some of the causes:
(1) Started too late.
(2) Additional (unknown) inadequately treated risk factors.
(3) Non compliance.
(4) Non responders.
(5) Insufficient treatment.

In real life, one can start the treatment earlier as primary prevention. Once again, we need to stress global risk and treat all modifiable risk factors. We may need to set new lower targets (the LDL-C level for 6 month old baby is 1.56mmol/l).

High dose statin may have additional pleotrophic effect. It can decrease inflammatory markers e.g. CRP level. Statin trials can reduce the cardiovascular event by 19% to 35%. In the HDL Atherosclerosis Treatment study (HATS), the combination therapy with simvastatin + niacin, alone or in association with antioxidants and vitamins, produces a statistically significant reduction in the composite end point between 90% to 60%, respectively, compared to placebo.

In the ARBITER - III trial, among 57 participants treated with extended - release niacin (ERN) for 24 months, there was additional significant regression of CIMT.

Metabolic syndrome is a potential major risk factor for coronary artery disease. The following are the criteria for metabolic syndrome:

**Defining Metabolic Syndrome**

Individuals with any of the following:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Waist circumference</td>
<td>&gt;102 cm (&gt;40 in)</td>
<td>&gt;88 cm (&gt;35 in)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>≥1.7mmol/l (130 mg/dl)</td>
<td>≥1.8mmol/l (40 mg/dl)</td>
</tr>
<tr>
<td>HDL-C</td>
<td>≥1.3mmol/l (40 mg/dl)</td>
<td>&lt;1.29mmol/l (50 mg/dl)</td>
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<tr>
<td>Blood pressure</td>
<td>≥130/85 mm Hg</td>
<td></td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>≥6.1mmol/l (110 mg/dl)</td>
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According to Framingham heart study, high level of HDL-C has a protective role (HDL-C > 1.68mmol/l). Apart from LDL-C lowering, efforts should be considered to raise HDL-C. Regular exercise is effective in raising HDL-C in certain subset of patients.

In a study which assesses the benefit of exercise, among the 59% of the activity-related reduction in CVD. Inflammatory/haemostatic biomarkers (high-sensitivity CRP, fibrinogen, and soluble intracellular adhesion molecule-1) provided the largest contribution to lowered risk (33%), followed by blood pressure (27%), lipids (19%), body mass index (10%), and glucose abnormalities (9%), with minimal contribution observed from measures of renal function or homocysteine (<1%). The inverse association between physical activity and CVD risk is mediated in substantial part by known risk factors particularly inflammatory, haemostatic factor and blood pressure.

Modern imaging techniques such as CT coronary angiogram can visualise the coronary anatomy. It enables us to pick up early atherosclerosis. In the presence of calcification, the accuracy of this technique has dramatically decreased. At present, I do not use this as a screening procedure because of the high dose of X-ray exposure.

Carotid artery intimal thickness study is useful in the assessment of atherosclerosis. It can provide a visual image to your patients.
It can help us to make clinical decisions and is affordable in our daily practice. It can be repeated as frequently as necessary. In future, half-hearted approach is not useful in the prevention of atherosclerosis. Total risk management is essential.

References

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