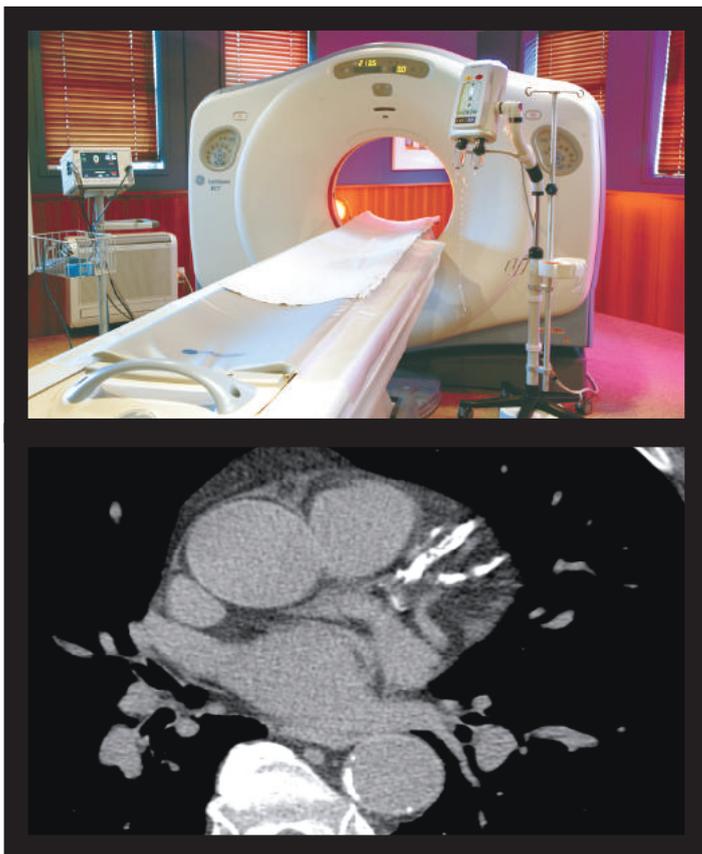


# The Heart♥ Group

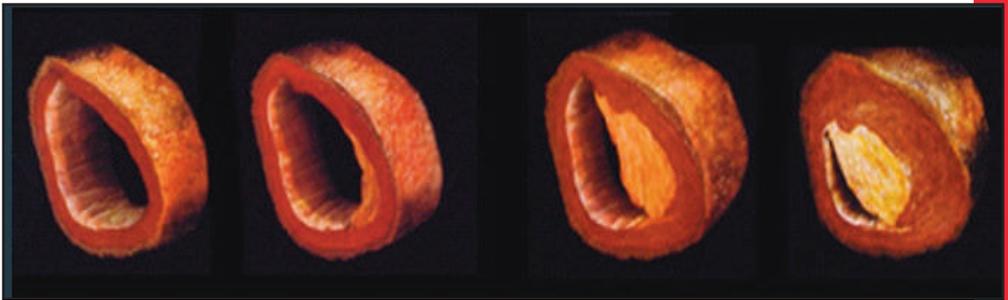
## CT Calcium Score Test





## Atherosclerosis in a Coronary Artery

- Coronary artery disease is caused by the build up of fatty deposits in the arteries (Fig 1).
- These fatty deposits are called ‘plaques’ and the process is called ‘atherosclerosis’.
- Plaques can narrow the arteries and cause symptoms such as chest discomfort or ‘angina’.
- Plaques can also ‘rupture’ and cause heart attacks, with a small blood clot forming within the coronary artery causing a blockage.



*Fig 1. The build up of coronary plaque.*

## The Computed Tomographic (CT) Calcium Score Test

- The calcium score detects calcium within the coronary arteries.
- The calcium is deposited within the ‘plaques’ of cholesterol and fat build-up on the inside of the coronary artery.
- Most (but not all) atherosclerosis eventually becomes calcified, this being the basis of the “hardened arteries” which occurs in everyone as they age, but at different rates and to a variable extent.

## Why is a CT Calcium Score test important?

### *Current Assessment of CVS Risk:*

The assessment of 'cardiovascular (CVS) risk' is important to predict which individuals may be at more risk of a heart attack, stroke, or death. These people can be more carefully managed with prevention strategies. However, our current methods used for CVS risk assessment are quite inaccurate. They are based on large community studies which follow people over time, to see who actually suffers from a heart attack, stroke, or death, and then the "risk factors" which might "predict" this CVS 'event' are found.

### *New Zealand Guidelines:*

There are 6 major risk factors which are currently used:

- A high total cholesterol and a low 'good' cholesterol
- High blood pressure
- Smoking cigarettes
- Diabetes mellitus
- Male gender
- Advancing age

These are the main risk factors which are part of the "Framingham equation" which is used in the basic New Zealand guideline assessment system. Some extra risk is also given to people with a strong family history of heart disease, Maori, Pacifica or Indian sub-continent people, and those with diabetes and kidney problems, and those who are overweight.

- The 6 major risk factors are a good way to start CVS risk assessment.
- Many risk factors, particularly a family history of CVS disease, are not well assessed.
- These other risk factors include a high lipoprotein (a) and a raised 'highly-sensitive' CRP and genetic influences which are not calculated with this standard CVS risk method.
- The CT calcium score gives very useful information in addition to the standard CVS risk assessment.

### **CT Calcium Score Test:**

- A CT calcium score test is important because it looks at the problem of CVS risk from a different angle.
- Whatever the known or unknown risk factors that a person may have, a CT calcium score identifies those who *actually have* more ‘hardening’ of their arteries (calcium in the arteries).
- Large studies have shown that the calcium score is highly predictive of future CVS events.
- In reality this is quite logical as if there is more “sludging-up” and “hardening” of the arteries a person would intuitively be more likely to have severe narrowings or sudden blockages.

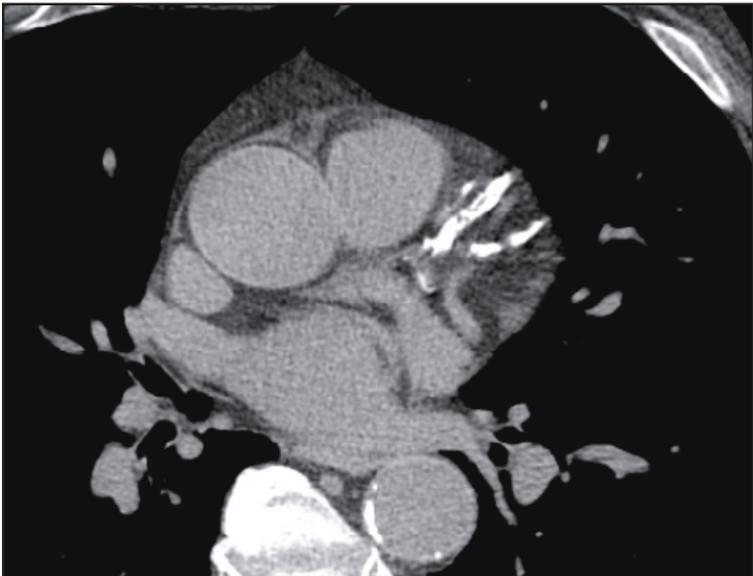
### **Use of CT Calcium Score Test:**

- The calcium score gives information about the likelihood of a heart attack or other cardiac event which is additive to the standard Framingham type risk assessment.
- The absence of coronary calcification (a calcium score of zero Agatston units) is associated with a very low risk of CVS events, estimated to be < 1% over a 7-10 year period (Fig 2).
- Conversely higher calcium scores are associated with a higher relative risk, particularly when the calcification is high compared to other people of the same age. (Fig 3).
- A calcium score of greater than 400 Agatston units confers a 10 to 30 times greater risk of a heart attack or other cardiac event compared to a score of zero.

The CT calcium score is a stronger predictor of CVS risk than other biomarkers such as high sensitivity CRP (C-Reactive protein blood test) and carotid artery intimal thickness, and in several studies has been more predictive of risk than the entire Framingham risk assessment (the ‘usual’ risk assessment tool).



*Fig 2. Absence of coronary calcification (calcium score=0)*



*Fig 3. Extensive coronary calcification of the left anterior descending artery ( calcium score =786)*

## Who should be referred for a calcium score test?

A calcium score should **only** be used to help assess CVS risk in people **without any symptoms**.

- People can be referred who are at ‘low’, ‘intermediate’ or ‘high’ risk using the standard methods.
- In all of these risk groups an advantage to calcium scoring has been seen, although most often those patients who are at an “intermediate” risk would be those who are referred.

### *Patients:*

- Most patients would be between the age of 40 and 70 years of age with one or two risk factors such as a strong family history, high blood pressure, high cholesterol, diabetes or a history of smoking cigarettes.
- *But* patients outside of these age groups can also be considered to have a calcium score scan if they want to know the state of their arteries.
- Calcium scoring can often ‘reclassify risk’ in patients; usually from intermediate to either low or high risk.
- For example, a high calcium score in a patient at intermediate risk based on risk factor assessment identifies them as actually being at high risk. These patients are more likely to benefit from more intensive prevention measures, such as lipid lowering medicines.



*Fig 4. High speed CT X-Ray scanner*

## Who should *not* be referred for a calcium score?

- Patients **with CVS symptoms** such as chest pain, shortness of breath with exertion, palpitations, or other symptoms related to heart problems should have a full cardiology assessment, and **not** just a calcium score test.
- If there is a suspicion of severe coronary artery disease then a ‘functional’ test such as an exercise treadmill test, stress echocardiogram or a stress scintigram should be considered.
- Sometimes an anatomical diagnostic assessment should be used, such as a full CT cardiac angiogram or a conventional cardiac angiogram. Both of these two tests require the injection of intravenous or intra-arterial dye to image the coronary arteries.

## How is a calcium score test performed?

- A calcium score test is performed using a high speed CT X-Ray scanner, (Fig 4).
- The scan is performed with ‘ECG gating’ so that images are only acquired when the heart is relatively motion free.
- No contrast is required.
- A dose of a medicine to slow the heart (usually metoprolol or verapamil) is often given prior to the scan to lower the heart rate and improve image quality.

## Is there any risk involved?

No. The CT scan for the CT calcium score requires no contrast and only a very small amount of radiation: a similar dose to a mammogram (1mSv) which is considered very safe.

## How is a calcium score test reported?

- Coronary calcification is detected and a calcium score is calculated.
- This is an absolute score, dependent on the density and volume of coronary calcification and typically ranges between 0 and 1000 ‘Agatston units’.
- A percentile score is also given, adjusted for age and gender based on calcium scores from a large population study. This allows a person to see if they have more or less calcium in their arteries compared to other people of their age and gender.
- A Radiologist also reports on the non cardiac structures such as the lung and mediastinum.

## What action should be taken if there is a high calcium score?

If the patient's calcium score places them in the 75th to 90th percentile, or particularly above the 90th percentile for the age and gender matched “normal population” they are at much higher risk. Their calcium score will be compared with a comparison, normal population of 30,000 people.

Such patients will be at significantly increased risk, and will need to be vigorously managed. Some of these patients particularly those above the 90th percentile, (i.e. within the top 10% of “calcium score risk”) who have not previously seen a cardiologist, may then be referred to a cardiologist for a functional test or an anatomical test, and for additional advice regarding risk factor management.

- If a calcium score is  $>100$ , then a functional test such as a treadmill test should be considered.
- If the score is  $>400$  a functional test is usually advised. There may be silent, but flow limiting stenoses requiring a CT or conventional angiography to image the coronary lumen.

## What is the cost of the scan?

- The calcium score scan is simply an assessment of CVS risk, although a highly efficient and scientifically proven assessment.
- The calcium score test is reimbursed under some medical insurance policies and the cost is available from The Heart Group secretaries (09 623 1020).







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