I. Coronary Artery Disease **(CAD)**

1. What is it?

Coronary atherosclerosis is the blockage of the coronary arteries, which supply the heart with blood. This is typically called coronary artery disease or, in short, CAD. If the blood supply is decreased to an area of the heart, that portion of the heart muscle becomes "ischemic". Ischemic heart disease is a chronic heart disease that begins in early adulthood and progresses gradually throughout life. Ischemic heart disease is the leading cause of myocardial infarction (the loss of heart muscle or "heart attack"), congestive heart failure (the overall loss of strength of the heart), cardiac arrhythmias (irregular heartbeats or "arrhythmia") and sudden cardiac death.

Coronary artery disease (CAD) can develop in anyone, but the incidence increases with age and is correlated with many well-known risk factors.

2. Risk Factors for CAD

- A high level of LDL cholesterol "bad cholesterol"
- A low level of HDL cholesterol "good cholesterol."
- Hypertension (high blood pressure)
- Diabetes
- Family history of Coronary Artery Disease
- Cigarette smoking
- Obesity
- Physical inactivity

Although CAD develops more readily in patients who have a combination of risk factors, it does develop in patients who lack the presence of these traditional risk factors. Conversely, patients that have many coronary artery disease risk factors may never develop the disease.

3. Symptoms of CAD

- **Chest Pain**. If the blood supply to the heart is not adequate then chest pain or "angina" can develop. This symptom varies but classically consists of tightness in the chest. It can be brought on under certain situations such as, physical activity, exposure to the cold, emotional stress, etc.
- **Fatigue**. Usually described as a "change" in what a patient is able to do.

- **Shortness of breath**. Some patients have none of the chest pain described above but notice that they develop shortness of breath with certain activities. The shortness of breath (like the chest pain) is sometimes noticeable only with certain activities such as climbing stairs.
- **Heart Attack or Myocardial Infarction**. If the blockage of the blood flow is significant enough, heart muscle in that area dies. The symptoms vary but usually include intense, prolonged chest pressure accompanied by nausea.
- **No symptoms**. This is referred to as "silent ischemia". Blood supply to the heart is limited due to coronary artery disease but there are no obvious symptoms. This silent ischemia appears to be especially common in diabetics, possibly due to nerve damage.

The symptoms of CAD are variable. Perhaps the most consistent of all symptoms, is anything that seems new, unusual or limits what a person can do. Many times when a patient is diagnosed with coronary artery disease, they can recall noticing that something (possibly those things listed above, possibly not) changed in how they had felt.

II. Screening and Diagnosis of Coronary Artery Disease

1. **Screening for the traditional risk factors of CAD**. Detection and aggressive treatment of the traditional risk factors, as listed above, are very successful at limiting coronary artery disease.

2. **E lectrocardiogram**. (EKG) This is a simple test done in the office where electrodes are attached to the chest. This test can show evidence of a previous heart attack or, at times can show when a heart attack is in progress. It also can give information on the electrical activity of the heart, information on the heart muscle and other valuable information. However, this is not very useful in predicting coronary artery disease.

3. **Stress tests**. The routine exercise stress test and the more involved imaging stress tests have been used to detect the presence of coronary blockages. These are extremely useful in certain situations, especially in the presence of chest pain. Both are limited in that they only detect blockages that are already quite significant. There has to be blockage extensive enough that blood supply to a portion of the heart muscle is compromised. For a variety of reasons, these tests are not always successful at predicting CAD and even advanced blockages can be missed in certain situations.

4. **Cathete rization.** This test involves the injection of dye into the coronary arteries and is very good at finding blockages in the coronary arteries. However, the test is limited. Blockages that do not appear to be significant on the catheterization may, at times lead to a heart attack. In addition, this test is expensive and does carry some risk. Despite these limitations, the catheterization remains the "gold standard" of diagnostic studies for CAD.

5. **Echocardiogra m**. This test uses sound waves to produce an image of the heart. It is excellent at getting information about the strength of the heart and whether a portion of the heart muscle is damaged. At times it can be combined with a stress test, a "stress echo", and give even more information in regard to coronary artery disease. Like the other stress tests, the stress echo is limited in that it will be positive only when significant coronary artery disease has already developed.

6. **Ultrafast CT Scan**. This exciting, new technology has just become available at the UnaSource building and is described below.

III. Ultrafast CT Scan of the Coronary Arteries

1. Why has this been developed?

Despite the great information now available about coronary artery disease and heart disease in general, it is still the major cause of death in the United States. There is no question that preventing this disease is, and should remain, a number one priority. However, approximately one third (1/3) of people with blocked arteries have no warning symptoms prior to a heart attack. **Up to 25% suffer sudden death as the very first sign of heart disease!**

Obviously, there is a great need to detect this killer disease prior to these events. Early detection of CAD is the goal of an Ultrafast CT scan.

2. What is an Ultrafast CT Scan?

This "souped up" CT scanner takes cross section images of the coronary arteries to help determine the risk of CAD. The images obtained by the Ultrafast CT scan are "timed" to the heartbeat allowing a "freeze" view of the heart. The scan measures calcification in the coronary arteries, which is associated with the presence of coronary artery plaque. With the advancement in this technology, it has become possible to detect even small amounts of calcium. This affords an opportunity to detect early coronary artery blockage, before the patient develops symptoms' and possibly, at a stage prior to when a traditional stress test would indicate the blockage.

3. **What exactly does the Ultrafast CT show?**
   The images from the Ultrafast CT scan include various parts of the heart. The most useful at this time are views of the coronary arteries, which supply blood to the heart. The CT scan detects the development of plaque in the coronary arteries by measuring the amount of calcium build up in these arteries. The appearance of calcium in the artery wall is associated with active atherosclerosis in many cases. This calcium can be present at a very early stage of the disease when it would be most useful to intervene, or later when more advanced blockage is present.

4. **What is a "calcium score?"**
   The amount of calcium that is detected by the CT scan varies based on factors including a person's age, gender, etc. The Ultrafast CT scan will provide a measure of this calcium and **when interpreted with other risk factors** gives an indication of the presence or absence of coronary artery disease. Although this information appears superior to traditional tests in predicting early CAD there are still significant limitations in its use.

5. **How is the test done?**
   An Ultrafast CT scan is very simple to obtain and the patient needs no preparation (although it is suggested that caffeine and decongestants be avoided). The patient lies down on an examination table with electrodes for the EKG on their chest. While the heart rate is monitored the CT scanner obtains "pictures" of the coronary arteries. The test takes only a few minutes. There is no IV or contrast dye involved.

6. **Who should have the Ultrafast CT scan?**
   The Ultrafast CT scan is only one of many diagnostic tools used to evaluate a patient's "heart health". In general, the test should be reserved for patients who have certain risk factors for coronary artery disease and in whom documentation of coronary artery disease would be expected to change or influence therapy. For example, patients with mildly elevated cholesterol, hypertension, etc. could benefit in that positive results may lead to more aggressive risk factor treatment. Patients with relatively early family history of coronary disease likewise may benefit, in that their traditional and non-traditional risk factors could be individually addressed and treated.
   In other settings, such as in the emergency room with patients suffering from unusual chest pain, or in patients with cardiomyopathy, this technology may someday prove useful.

7. **Who should not have Ultrafast CT scan?**
   There is a limited group of patients who would benefit from this technology. Young, healthy individuals under the age of 35 or 40 would likely not benefit unless there was compelling reasons to worry about coronary artery disease such as very early family history. Likewise, patients who are over 70 often accumulate some calcium in their arteries on a routine basis, making interpretation difficult and rendering the test unhelpful in those patients. Patients who have a very fast or irregular heartbeat will not be able to have the test because the quality of the test depends on a steady rhythm. Patients who are pregnant or potentially pregnant should not undergo the test because of the exposure to x-rays. The machine is limited to 300 pounds (Patients above this level cannot be scanned).

   It is obvious that each patient is unique and the need for this (or for that matter any medical test) will need to be individualized.

8. **Limitations of Ultrafast CT Scan.**
   Ultrafast CT scan is not helpful in defining the exact location of blockage in the coronary arteries. The test also has limited value in defining clinical prognosis (i.e., the risk of having a heart attack). Non-calcified plaque (i.e., soft plaque) may be significant and not detected.

   Research is on going to overcome these limitations and make Ultrafast CT scan even more valuable.

9. **Ultrafast CT scans compared with other cardiac testing.**
   The Ultrafast CT scan is extremely sensitive at detecting the presence of early coronary artery disease and is correlated with the overall extent of plaque.

   Other valuable heart studies include:

   Nuclear (imaging) stress testing remains the best test (although limited in its own way) for defining prognosis. Patients with significant calcium scores may need to undergo this test to further evaluate the coronary arteries (This decision must be based on the calcium score as well as other factors).

   Echocardiogram The "Echo", which uses sound waves, is excellent at evaluating the valve structures and overall heart function. For this type of information, the Echo is the preferred test.

Catheterization is still the "gold standard" for evaluating the arteries of the heart. It detects specific locations of coronary artery blockage and certainly is needed before many of the more aggressive treatments (for instance angioplasty, coronary artery bypass graft, etc.) can be used.

10. Other important questions.

Q. What is coronary calcification?

A. Coronary calcification, also known as "hardening of the arteries" occurs when calcium is deposited along the walls of the arteries. The calcium stiffens the blood vessels as part of the atherosclerotic process. Research shows that there is a link between the degree of calcification and the amount of atherosclerotic plaque.

Ultrafast CT scan gives a measure of this calcium and suggests how advanced a patient's atherosclerotic process is, thereby guiding the aggressiveness of treatment.

Q. Is the test painful?

A. The test is fast, painless and non-invasive. There is no preparation other than putting on a gown. There are no needles or injections and there is nothing to eat or swallow. The technologist will have the patient lie on the bed of the CT scanner and monitor the heart rate. Electrodes will be placed on the patient's chest to follow the heart rate and the patient will be asked to hold their breath during the scan.

Q. What results will I receive?

The Ultrafast CT scan will supply a "total calcium score". It must be interpreted, with the assistance of your physician in combination with many factors, including age, gender, and other risks for CAD. A low score does not always mean that coronary artery disease is absent (although it is less likely). A high score does not necessarily mean that significant coronary artery disease is present.

Q. Will my physician receive the results?

A. Prior to having the test, a Patient Data Form will need to be filled out completely. Results will be sent to the physician indicated on the Patient Data Form. If a physicain is not indicated on the form, one of our physicians will call you to discuss your test results with you. If you would like to schedule an appointment with one of our physicians, please call (248) 267-5000 to check insurance coverage, physician availability, and to schedule.

Q. What are the results used for?

A. The information gathered from this test, in conjunction with other available information will help your physician suggest evaluation and treatment options. Healthy living, which includes no smoking, regular exercise, good diet, etc. should always be followed.

Q. How much does it cost?

A. $175. Payment is expected prior to undergoing the test.

Q. Will my insurance pay for this exam?

A. At this time, most insurance companies consider an Ultrafast CT scan a non-covered service. A bill will be supplied for you to submit to your insurance if desired.

IV. Results

The Ultrafast CT scan can give very valuable information about the coronary arteries, by measuring the amount of calcium associated with a person's arteries. This "calcium load" correlates with the amount of atherosclerosis or plaque. Although the test is very helpful, limitations make interpretation very important. We strongly encourage any patient who undergoes this test to review it with their physician and to view the results as only one piece of information.

V. What to do to get the test.

If you believe you meet the criteria for someone who would benefit from the Ultrafast CT scan test, we encourage you to review it with your physician. When the need for the test is determined, you can call (248) 267-5000 and press #8 to schedule. To schedule a cardiac calcium scoring test or email a question regarding this test, click here. You will be asked a series of questions. You will need to arrive approximately one half hour prior to your scheduled test in order to fill out the Patient Data Form. Payment will be expeted at that time. It is requested that you sign-in, fill out paperwork and pay on the third floor of the UnaSource Health Building at Troy Internal Medicine. Simply identify yourself as an Ultrafast CT scan patient and you will be guided through the process.