

## Coronary Angiography and Angioplasty: A Patient's Guide to Pre-and-Post Procedure



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### Dear Patient,

Your doctor is concerned that you have Coronary Artery Disease (CAD). This brochure provides essential information about the disease and its associated symptoms. It also explains current treatment options. We have also included a glossary of medical terms at the end of the brochure.

Information in this brochure is given as a guide only and does not replace medical advice from your doctor. Please seek the advice of your doctor if you have any questions related to the surgery, your health or medical condition.

# Content

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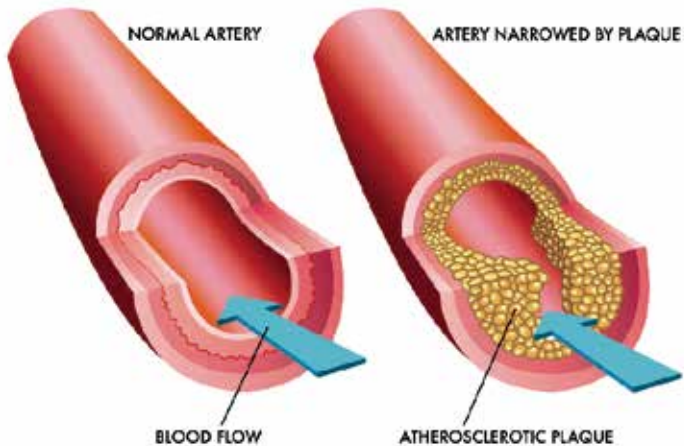
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# Coronary Artery Disease

Coronary Artery Disease (CAD) develops when the arteries that supply blood to your heart become narrowed or blocked by a build-up of fatty deposits called plaque. As a result, it gets harder for the arteries to supply blood to the heart.

## Symptoms of CAD may include:

- Chest pain (angina)
- Shortness of breath
- Heaviness in the chest
- Pain in the jaw or down the arms
- Heartburn
- Nausea
- Vomiting
- Heavy sweating



## There are a number of risk factors for CAD

Certain risk factors are beyond your control, including:

- Age
- Family history of heart disease

However, the majority of risk factors can be controlled. When addressed successfully, these factors can reduce the risk of further heart disease:



**Smoking** decreases the amount of oxygen delivered to the heart, and increases the risk of developing deadly blood clots.



**Obesity** or excess body fat, particularly around the waist, can be a cause of increased blood pressure and high blood cholesterol.



**Lack of physical activity** or an inactive lifestyle may contribute to CAD.



**High blood pressure** places a strain on the heart and directly damages blood vessels, making it easier for plaque to form.



**Diabetes** causes excess sugar to build up in blood vessels and damages nerves.



**High cholesterol** in the blood can lead to atherosclerosis, or the build-up of thick, fatty plaque that clogs arteries.

# Diagnosing CAD

If your doctor suspects that you have CAD, you'll likely be asked to take a physical exam to check your heart and see how well it is working. Some of the tests used to diagnose CAD include:



## 1. Electrocardiogram (ECG)

Records your heart's electrical activity in order to identify an abnormal heartbeat or damage to the heart muscle.



## 2. Stress test

Evaluates your heart rate and rhythm while you are exercising.



## 3. Echocardiogram

Measures the chambers and heart function using sound waves and check your valves and major blood vessels.

# What is Coronary Angiography?

## 4. Coronary Angiography

Coronary angiography is a procedure to visualize the coronary arteries. The coronary arteries are the blood vessels that supply blood to the heart muscles. On ordinary chest X-ray films, the heart appears as a silhouette and the coronary arteries cannot be seen.

To see the coronary arteries, a special dye or contrast medium is injected through a small tube (catheter) inserted via a large artery in the groin or the wrist. The catheter is then advanced to the heart and positioned at the openings of the coronary arteries before injection is performed.

After the catheter placement and filming, which normally takes about 15 to 30 minutes, the catheters will be removed. Upon removal, the doctor will discuss his findings with you. If necessary and you are agreeable, he may proceed directly to coronary angioplasty.



Shows blocked artery

# Treatment Options for CAD

Treatment of CAD usually begins with **lifestyle changes** and/or **medications** that help the heart work more efficiently and improve blood flow to the heart muscle.

If these initial treatments are unable to control the symptoms of CAD, an interventional procedure may be required. The same is true if the narrowing of the artery is so great that the lack of blood flow is starving the heart muscle of oxygen.

Interventional procedures that are “minimally invasive” include balloon angioplasty, coronary artery stenting, and a Bioresorbable Vascular Scaffold (BVS).

Depending on your medical history or the condition of your blocked artery, coronary bypass surgery may be preferred.

This uses a healthy blood vessel taken from the chest, leg, or arm to redirect the flow of blood around a section of blocked artery within the heart.



**Balloon Angioplasty** – a small balloon is inflated within the narrowed portion of a blocked artery, pushing plaque against the artery walls and improving blood flow to the heart.



**Bare Metal Stent** – a metallic mesh tube that is delivered on an angioplasty balloon to the narrowed portion of an artery to permanently support the artery walls and improve blood flow.



**Drug-eluting Stent** – a metallic coronary artery stent, permanently implanted in an artery, which has been coated with medication to prevent an overgrowth of the artery lining that can occur as a reaction to stent implantation.



**Bioresorbable Vascular Scaffold (BVS)** – the latest advance in CAD therapy, a nonmetallic mesh tube that is delivered on an angioplasty balloon to treat a narrowed artery, similar to a stent, but slowly dissolves once the blocked artery can function naturally again and stay open on its own.



# Your Coronary Angioplasty Procedure

Feeling comfortable with the treatment decision is important, so take time to learn about the procedure and ask your doctor questions.

## Preparing for your procedure

In preparation for your procedure, your doctor will provide you with specific instructions such as not eating or drinking anything beforehand on the day of the procedure. Your doctor will also ask you about:

- Medications you are currently taking
- Medications you cannot take or may have an allergy to
- Any history of bleeding problems you may have
- Any metal allergies you may have
- Any surgery or dental work you may be due to have soon.

If you are a woman, your doctor may also want to know whether you are pregnant or nursing, or have any plans to get pregnant.

Some routine investigations, including blood tests, an electrocardiogram (ECG) and a chest X-ray may be done before the procedure. You will normally fast 6-8 hours before the procedure. You will also need to sign a consent form after your doctor has explained to you the risks of the procedure.

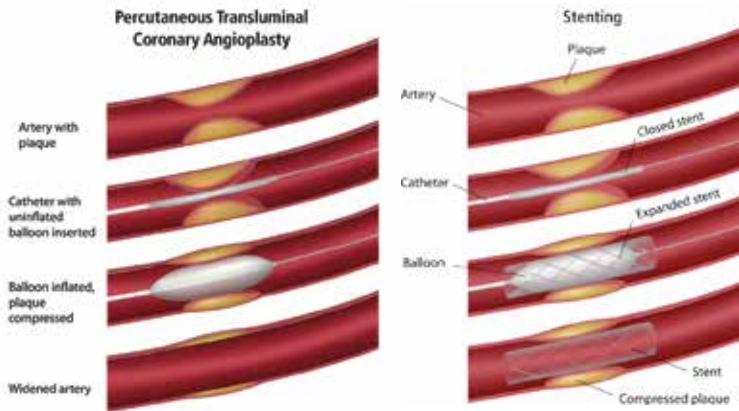
## Your procedure

On the morning of your test, you will be asked to empty your bladder and skin shaving, usually of your groin and upper thighs, will be done. You will be placed on a movable table, with X-ray cameras and LCD monitors around you. A nurse will clean your groin or wrist and then drape you with sterile towels. After an injection of a local anesthetic, a plastic tube called a sheath is inserted in a large artery in the groin or wrist. Through this sheath, another long and narrow tube (catheter) is advanced to the origin of the narrowed coronary artery. A coronary angiogram is done first to provide a “road map” for the Percutaneous Transluminal Coronary Angioplasty (PTCA).

In PTCA, a fine wire is then threaded through the catheter and advanced into the coronary artery across the narrowed segment. This wire serves as a rail over which the balloon catheter is finally delivered and positioned over the area of narrowing for focused angioplasty to open the narrowed segment.

The procedure may be terminated here or followed by another procedure called stenting where a small metal or polymer coil is placed to serve as scaffold. The procedure may take from 1/2 to 2 hours, depending on the complexity of the diseased artery.

1. Your doctor will use a special X-ray machine to see the scaffold or stent in your artery and to assess how well the artery has been opened up.
2. Once blood flow is restored, the balloon is removed.
3. The stent or scaffold is left behind, and may slowly release medication to treat the diseased area.



## After your procedure

The sheath may be kept in your groin artery for 4 to 6 hours. Alternatively, the sheath may be removed in the laboratory immediately after the procedure if the situation allows. Upon removal of the sheath, the puncture site will be compressed for about 30 minutes to ensure that there is no bleeding. You will have to remain in bed for several hours following a groin puncture to ensure sufficient healing of the puncture site before walking. Your cardiologist will determine how long you need to be in bed before ambulation. Some blood tests and ECGs may be performed to monitor your condition. If there are no complications, you may be discharged on the same day or the day after.

Catch the procedure on our patient education video!

**You Tube** [www.youtube.com/user/NUHCS](http://www.youtube.com/user/NUHCS)

# Potential Risks and Complications

In general, major complications such as heart attack, abnormal heart rhythm, stroke, trauma to the blood vessels, major bleeding, drug allergy, need for emergency surgery, and death, occur in less than 1% of patients undergoing PTCA. This risk is dependent on the complexity of coronary narrowing and the patient's underlying medical conditions and may therefore be higher if the patient has comorbid conditions, eg. advanced age, renal failure.

Other less serious complications occur in 1-3% and include bleeding from the puncture site, bruising and swelling of the puncture site, and blood clot formation in the artery where the sheath is inserted.

Overall, the procedure is very safe and well tolerated. The other risks are those that pertain to local anaesthesia, sedation, and blood transfusion. Conscious sedation and local anaesthesia are generally applied to alleviate anxiety and procedure discomfort.

Following successful balloon angioplasty or stent implantation, there is still a possibility that narrowing of the heart artery may recur. This may occur either in the same area, a different segment, or a different artery. This is more likely with extensive coronary artery disease and inadequate control of risk factors. It is therefore important for you to be compliant to the prescribed medications and return for regular medical reviews.

These risks are tabulated below:

### Risks of conscious sedation and local anaesthesia

#### Common (1 to 10%)

Low blood pressure

Giddiness, nausea, and/or vomiting

Pain and inflammation at injection site

### Risks of transfusion

#### Common (1 to 10%)

Skin reactions and rashes (1 to 2%), fever (0.5 to 1%)

#### Uncommon (0.01 to 0.1%)

Allergic reactions

Respiratory depression, which may require ventilator support

Inflammation of veins

#### Uncommon

Bacterial contamination during platelet transfusion (0.01 to 0.1%)

#### Rare (0.001 to 0.01%)

Cardiorespiratory arrest and death

#### Rare

Mis-transfusion (0.008%)

Viral transmission of Hepatitis B, C, HIV or etc. (0.0001 to 0.001%)

Acute haemolytic reaction (0.0002%)

Bacterial contamination (0.0001%)

# Home Advice After an Interventional Procedure

## Activities

- Refrain from physical exertions like heavy housework.
- Avoid heavy lifting of not more than 5 kg until you recover.
- Take short walks or strolls depending on your physical condition.
- If you feel well after 2 weeks, increase gradually to normal walks.

## Driving

- It is recommended to avoid driving for 2 weeks.
- If you are presently admitted for a heart attack, it is best to avoid driving for a month.

## Going Back to Work

- It will depend on your progress. Seek the opinion of your doctor.

## Medication

- Take your medication as prescribed. You should not discontinue your medication without first discussing with your doctor.

## Sex

- This depends on the individual but generally you can resume your normal sexual activity 4 weeks after your procedure, only if you feel good and well rested.

## Travel

- Avoid aircraft traveling for 1 month or as per doctor's advice depending on condition.

## Wound Care

- If the insertion site is increasingly painful, swollen, red, bleeding or the bruise is increasing in size, seek medical help or go to A&E.

## Preventing Further Damage to the Heart

- **Recognize an Angina**

You may experience any of the following:

1. Temporary pain, tightness or discomfort in the centre of the chest.
2. Pain may spread to both sides of the chest, neck, jaws, shoulders and down the inner sides of the arm.
3. A feeling of pressure in the chest.

- **Recognize a Heart Attack**

You may experience any of the following:

1. Prolonged or severe chest pain, discomfort or pressure.
2. The pain may radiate to the neck, jaws, shoulders, arms, back or upper abdomen.
3. Severe shortness of breath.
4. Excessive sweating.
5. New or very severe palpitation (when you feel your heart is beating very fast).
6. There may be nausea, vomiting, gastric discomfort, dizziness or weakness.

- **What should you do if you recognize an angina or a heart attack?**

1. Take a GTN (Glyceryl Trinitrate) tablet or spray.
2. After 5 minutes if the pain is not relieved, you may take a second one. If pain persists after 5 minutes, take a third one.
3. However if pain is still present, call 995 for an ambulance to go to A&E.

# Eat Everything in Moderation

## 1.Reduce your fat intake

- Trim visible fat off meat and poultry.
- Try low fat cooking methods such as steaming, grilling, baking and boiling.
- Choose low fat dairy products (e.g. low fat milk, low fat cheese or yoghurt).
- Replace saturated fats such as butter, ghee and lard with unsaturated fats such as margarine and canola or olive oil. Use sparingly.
- Replace coconut milk with low fat milk.

## 2.Limit your dietary cholesterol

- Egg yolks, offal (e.g. brains, liver, and kidney) and shellfish (e.g. prawns and squid) contain rich sources of dietary cholesterol. When consumed excessively, blood cholesterol may be raised.

## 3.Watch your salt intake

- Cut down on added salt, monosodium glutamate (MSG) or soya sauce.
- Limit preserved and salted food such as instant noodle, canned food, preserved meat, salted eggs or salted nuts.
- Use herbs and spices to flavour your food such as fresh chilli, lime, onions, garlic, lemon and pepper.

## 4.Eat less sugar

- Ask for reduced sugar drinks and juices.
- Look for sugar free products.
- Eat fresh fruits instead of choosing fruit juices.
- Save sweets, desserts, kueh, cakes, chocolates and pastries for special treats only!



### 5. Eat more fibre

- Try unpolished rice, wholemeal bread, chapatti and wholegrain cereals.
- Include beans, lentils and legumes in your diet.
- Eat more fruits (if you are not diabetic) and vegetables.

### 6. Watch your alcohol intake

- Alcoholic beverages are high in calories, therefore consumption should be reduced to control your weight and particularly if your triglyceride level is raised.



# The Different Types of Medication Used for My Heart

After your interventional treatment, your doctor may prescribe medications to help prevent complications. These medications may include:

Class of medicines	Members of class	Uses of medicines	Common Side Effects	Precautions and advice
<b>Antiplatelets</b>	Aspirin	Help prevent the formation of blood clot and reduce the chance of heart attack or stroke.	<ul style="list-style-type: none"> <li>• Gastric irritation</li> <li>• Gastric bleed</li> </ul>	<p>Stop taking at least 5 days before any surgery, including dental surgery, unless otherwise instructed.</p> <p>Contact doctor if you experience gastric discomfort or pass black tarry stools.</p>
	Clopidogrel Ticlopidine Prasugrel Ticagrelor		<p>Contact doctor immediately if you have the following symptoms:</p> <ul style="list-style-type: none"> <li>• Unexplained sore throat</li> <li>• Fever</li> <li>• Mouth ulcers</li> <li>• Bruising</li> <li>• Bleeding</li> </ul>	
<b>Beta-blockers</b>	Atenolol Bisoprolol Carvedilol Labetolol Metoprolol Propranolol	<p>Reduce workload and oxygen demands of the heart to cope with reduced blood supply</p> <p>Also help to control blood pressure, chest pain, heart rate and prevent second heart attack.</p>	<ul style="list-style-type: none"> <li>• Tiredness</li> <li>• Dizziness</li> <li>• Cold hands &amp; feet</li> <li>• Shortness of breath</li> <li>• Nightmares</li> <li>• Impotence</li> <li>• Slow heartbeat</li> </ul>	<p>Contact doctor if shortness of breath becomes severe or persistent dizziness.</p> <p>Inform doctor if you have asthma or circulatory problems.</p>
	<b>ACE inhibitors</b>	Captopril Enalapril Lisinopril Perindopril Ramipril	<p>Prevent heart from weakening further.</p> <p>Also help control blood pressure to prevent heart attack, stroke and kidney failure.</p>	<ul style="list-style-type: none"> <li>• Dry cough</li> <li>• Changes in taste</li> <li>• Dizziness</li> <li>• Tiredness</li> </ul>
<b>Angiotensin II antagonists</b>	Candesartan Irbesartan Losartan Valsartan		<ul style="list-style-type: none"> <li>• Changes in taste</li> <li>• Dizziness</li> <li>• Tiredness</li> </ul>	

Class of medicines	Members of class	Uses of medicines	Common Side Effects	Precautions and advice
Lipid-lowering agents	Atorvastatin Lovastatin Pravastatin Simvastatin	Decrease production of cholesterol.	<ul style="list-style-type: none"> <li>• Constipation</li> <li>• Flatulence</li> <li>• Abdominal pain</li> <li>• Muscle pain</li> <li>• Stiffness</li> </ul>	Observe proper dietary instructions to optimise treatment.
	Bezafibrate Fenofibrate Gemfibrozil	Reduce fat formation.	<ul style="list-style-type: none"> <li>• Nausea</li> <li>• Rash</li> <li>• Itchiness</li> <li>• Muscle pain or stiffness</li> </ul>	Contact doctor if muscle pain, severe nausea, vomiting or yellowing of skin occurs.
Diuretics	Bumetanide Frusemide	Remove excess water in the body by increasing urination.	<ul style="list-style-type: none"> <li>• Nausea</li> <li>• Muscle cramp</li> <li>• Muscle weakness</li> <li>• Dizziness</li> </ul>	Take during the day to avoid waking in the night to go to the toilet.  Contact doctor if severe nausea, vomiting or diarrhoea occurs.
Potassium supplements	Potassium chloride	Supplement the loss of potassium (due to the effect of diuretics).		
Calcium channel blockers	Amlodipine Diltiazem Felodipine Lacidipine Nifedipine	Reduce oxygen demands and workload of the heart.  Relax blood vessels and help control blood pressure and chest pain.	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Flushing</li> <li>• Swelling of feet</li> <li>• Changes in heart rate</li> </ul>	Contact doctor if swelling of feet or fast heartbeat persist.
	Vasodilators	Glyceryl Trinitrate  Isosorbide Dinitrate  Isosorbide Mononitrate	Relax blood vessels.  Increase blood and oxygen supply to heart.	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Flushing</li> <li>• Dizziness</li> </ul>
Hydralazine		Nitrates reduce incidence of chest pain.	<ul style="list-style-type: none"> <li>• Palpitations</li> <li>• Flushing</li> <li>• Swelling of feet/lower legs</li> </ul>	Contact doctor if joint pain occurs.
Cardiac glycosides	Digoxin	Improve the strength and pumping action of the heart resulting in better blood circulation.	<ul style="list-style-type: none"> <li>• Nausea &amp; vomiting</li> <li>• Diarrhoea</li> <li>• Unusual tiredness</li> <li>• Visual changes</li> </ul>	Contact doctor if any side effect occurs.
Aldosterone antagonist	Spirolactone	Remove excess fluid in the body.	<ul style="list-style-type: none"> <li>• Weight gain</li> <li>• Breast tenderness</li> </ul>	

# Managing CAD After an Interventional Procedure

Once a CAD care plan has been established by your doctor, its success depends on your willingness to see it through.



**If you smoke, create a plan to stop.** There are supportive groups you can contact to help encourage you, as well as medications to make stopping easier.



**Try to lose weight, even if it's only a few kilograms.** Remember that even a 2.5 to 5 kg weight loss can significantly reduce your risk of heart disease.



**Make moderate exercise a part of your daily routine.** Regular physical activity is a great way to burn fat. It also releases natural chemicals such as endorphins and vasodilators that help to maintain healthy blood vessels.



**Monitor your blood pressure, cholesterol, and blood sugar.** In addition to having your blood pressure, cholesterol, and blood sugar checked regularly, be sure to limit your sodium intake, eat healthy foods, exercise regularly, maintain a healthy weight, and take all medications prescribed by your doctor.



**Visit your doctor regularly.** After being diagnosed with CAD, it's important to have regular check-ups with your doctor.

Don't try to become a new person overnight. Instead, select an area or two to work on and go from there. By setting achievable goals, you may be surprised at the level of success you'll reach.

- **Make changes gradually.** If you want to lose weight, work steadily towards a realistic goal – every kilogram you lose is a step in the right direction. If you want to reduce sugar in your diet, eliminate desserts a few days a week, but not every day. Small changes over time increase the chance of making a permanent change.
- **Enlist the support of friends or family members.** If your goal is to take more walks or join a gym, ask a friend to accompany you. You'll be much more likely to stick with an activity when it's social and fun.

## Cardiac Rehabilitation Programme at

This is a structured programme aimed at helping you to ease through the recovery period and gradually improve your heart fitness and live a healthier life. It will help you identify and change those behaviours or risk factors that may have contributed to the development of coronary artery disease.

The programme consists of:

- Prescribed exercise training
- Health education
- Risk factor modification

The team, which comprises a doctor, physiotherapist, cardiac rehab nurse, dietician, pharmacist, occupational therapist and medical social worker will guide and encourage you.

# Definitions of Common CAD Terms

**If you are unsure about what any of these terms mean, please ask your doctor.**

**Angina** – Chest pain caused by inadequate supply of blood to the heart.

**Angiogram** – a minimally-invasive procedure to allow your doctor to see blockages or narrowings in your coronary arteries on X-rays

**Angioplasty (also referred to as PTCA)** – A minimally-invasive procedure involving a balloon dilation catheter being passed through to the blocked area of an artery. Once inflated, the balloon compresses the plaque against the blood vessel wall. An angioplasty can also be performed with a stent.

**Anticoagulant** – A medication to prevent or slow the clotting of blood.

**Artery** – Muscular, walled tubes that are a part of the circulation system and are used to carry blood from the heart to various parts of the body.

**Atherosclerosis** – A disease that causes narrowing or blockage of arteries caused by a build-up of fat (cholesterol) within the artery wall. This buildup is sometimes referred to as “plaque.”

**Beta-blockers** – Post-CAD treatment medication that slows the heart rate and lowers blood pressure.

**Bioresorbable Vascular Scaffold** – An advanced treatment option for CAD that works like a stent but does not become a permanent part of the body because it dissolves over time once the artery can stay open on its own.

**Calcium channel blocker** – Post-CAD treatment medication that slows the heart rate, lowers blood pressure, helps widen coronary arteries, and reduces angina.

**Cardiac catheterization laboratory** – A sterile X-ray theatre in which heart catheterization (e.g. angioplasty) is performed.

**Catheter** – A thin, hollow, flexible tube used to access the coronary arteries during an angiogram or during an angioplasty procedure. The catheter can be used to inject medication, fluids, or X-ray dye during your procedure. The word catheter is also used to describe the device used to deliver the balloon or stent during an angioplasty procedure.

**Coronary arteries** – The blood vessels that carry oxygenated blood from the main artery (aorta) to the heart muscle. There are three major coronary arteries: the right coronary artery, the left anterior descending, and the left circumflex.

**Coronary artery disease (CAD)** – The formation of blockages or atherosclerotic plaques within the coronary arteries that result in restricted blood flow to the heart muscle.

**Bare metal stent** – A metallic mesh tube that is implanted into a coronary artery during an angioplasty, providing scaffolding to hold the artery open permanently and ensure blood flow to the heart muscle.

**Drug-eluting stent (DES)** – A metallic stent that has been coated with a drug to help reduce the risk of restenosis.

**Electrocardiogram (ECG/EKG)** – A test that records changes in the electrical activity of the heart. An ECG/EKG may show whether parts of the heart are damaged due to decreased blood flow to the heart muscle.

**In-stent restenosis** – Recurrent blockage or re-narrowing within a previously stented segment of the artery.

**Local anesthetic** – A substance used to numb the area to which it is applied.

**Nitrates** – CAD medication that relieves chest pain and other symptoms of angina.

**Plaque** – An accumulation or buildup of fatty deposits, calcium, white blood cells, and other substances in the wall of an artery that results in narrowing of the inside of the artery through which blood flows.

**Restenosis** – A recurring blockage caused by excessive cell growth inside the artery or stent following an interventional procedure such as angioplasty. When a stent has been used, restenosis within the stented segment is called in-stent restenosis.

**Statin** – Post-CAD treatment that lowers cholesterol, which may reduce the risk of heart attack.

## Location



### National University Hospital

5 Lower Kent Ridge Road, Singapore 119074

Tel: (65) 6779 5555 Fax: (65) 6779 5678 Website: [www.nuh.com.sg](http://www.nuh.com.sg)

### Contact Information

#### National University Heart Centre, Singapore

Located at 1 Main Building of NUH

**Opening Hours :** 8.30 am - 6.00 pm  
(Monday - Fridays)  
Closed on Weekend and  
Public Holidays

**Website :** [www.nuhcs.com.sg](http://www.nuhcs.com.sg)

**YouTube** [www.youtube.com/user/NUHCS](http://www.youtube.com/user/NUHCS)

### Getting to NUH

#### Circle Line Kent Ridge MRT Station

Commuters can transit at the Buona Vista MRT Interchange and alight two stops after at the Kent Ridge Station. The station will be served by three exit-entry points.

Exit A : Right at the doorstep of National University Heart Centre, Singapore.  
Exit B : Along South Buona Vista Road, which links to Singapore Science Park 1.  
Exit C : Leads to NUH Medical Centre.

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Every day, we save lives by providing financial relief to needy patients, funding groundbreaking research and giving training to our medical specialists. This is why the support we receive is essential.

Make a donation and help us continue the fight for every heartbeat!

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In collaboration with:

