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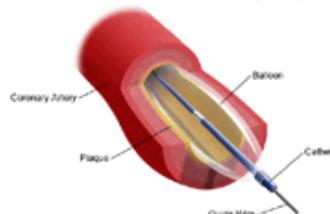
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## Percutaneous Transluminal Coronary Angioplasty/Stent Placement

### Procedure Overview

#### What is percutaneous transluminal coronary angioplasty (PTCA)?

Inflation of Balloon Inside a Coronary Artery



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Percutaneous transluminal coronary angioplasty (PTCA) is performed to open blocked coronary arteries caused by coronary artery disease (CAD) and to restore arterial blood flow to the heart tissue without open-heart surgery. A special catheter (long hollow tube) is inserted into the coronary artery to be treated.

This catheter has a tiny balloon at its tip. The balloon is inflated once the catheter has been placed into the narrowed area of the coronary artery. The inflation of the balloon compresses the fatty tissue in the artery and makes a larger opening inside the artery for improved blood flow.

The use of fluoroscopy (a special type of x-ray, similar to an x-ray "movie") assists the physician in the location of blockages in the coronary arteries as the contrast dye moves through the arteries. A small sample of heart tissue (called a biopsy) may be obtained during the procedure to be examined later under the microscope for abnormalities.

A technique called intravascular ultrasound (IVUS), a technique that uses a computer and a transducer that sends out ultrasonic sound waves to create images of the blood vessels, may be used during PTCA.

The use of IVUS provides direct visualization and measurement of the inside of the blood vessels and may assist the physician in selecting the appropriate size of balloons and/or stents, to ensure that a stent, if used, is properly opened, or to evaluate the use of other angioplasty instruments.

The physician may determine that another type of procedure is necessary. This may include the use of atherectomy (removal of plaque) at the site of the narrowing of the artery. In atherectomy, there may be tiny blades on a balloon or a rotating tip at the end of the catheter.

When the catheter reaches the narrowed spot in the artery, the plaque is broken up or cut away

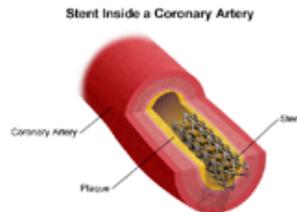
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to open the artery. Atherectomy is used when the plaque is calcified, hardened, or if the vessel is completely closed. Another type of atherectomy procedure uses a laser, which opens the artery by "vaporizing" the plaque.

### What is stent placement?

In the past few years, many refinements have been developed in the PTCA procedure. One common procedure used in PTCA is stent placement. A stent is a tiny, expandable metal coil that is inserted into the newly-opened area of the artery to help keep the artery from narrowing or closing again.



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Once the stent has been placed, tissue will begin to form over it within a few days after the procedure. The stent will be completely covered by tissue within a month or so.

It is necessary to take a medication, such as aspirin or clopidogrel (Plavix,<sup>®</sup>), which decreases the "stickiness" of platelets (a type of blood cells that clump together to form clots to stop bleeding), in order to prevent blood clots from forming inside the stent.

Newer stents (drug-eluting stents, or DES) are coated with medication to prevent the formation of scar tissue inside the stent. These drug-eluting stents release medication within the blood vessel itself.

This medication inhibits the overgrowth of tissue that can occur within the stent. The effect of this medication is to deter the narrowing of the newly stented blood vessel.

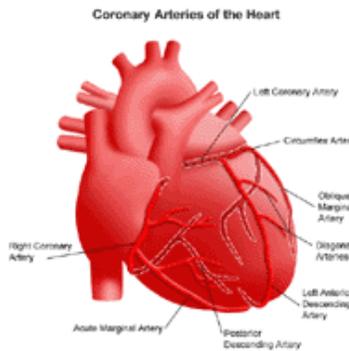
If scar tissue does form inside the stent, radiation therapy (called brachytherapy) may be used to clear the scarred area and open up the vessel.

Other related procedures that may be used to assess the heart include resting or exercise electrocardiogram (ECG or EKG), Holter monitor, signal-averaged ECG, cardiac catheterization, chest x-ray, computed tomography (CT scan) of the chest, echocardiography, electrophysiological studies, magnetic resonance imaging (MRI) of the heart, myocardial perfusion scans, radionuclide angiography, and ultrafast CT scan.

### Coronary artery disease

Coronary artery disease (CAD) is the narrowing of the coronary arteries (the blood vessels that supply oxygen and nutrients to the heart muscle), caused by a buildup of fatty material within the walls of the arteries. This buildup causes the inside of the arteries to become rough and narrowed, limiting the supply of oxygen-rich blood to the heart muscle.

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To better understand how coronary artery disease affects the heart, a review of basic heart anatomy and function follows.

The heart is basically a pump. The heart is made up of specialized muscle tissue, called the myocardium.

The heart's primary function is to pump blood throughout the body, so that the body's tissues can receive oxygen and nutrients and have waste substances taken away.

Like any pump, the heart requires fuel in order to work. The myocardium requires oxygen and nutrients, just like any other tissue in the body.

However, the blood that passes through the heart's chambers is only passing through on its trip through the body - this blood does not give oxygen and nutrients to the myocardium.

The myocardium receives its oxygen and nutrients from the coronary arteries, which lie on the outside of the heart.

### Angina

When the heart tissue does not receive an adequate blood supply, it cannot function as well as it should. If the myocardium's blood supply is decreased for a length of time, a condition called ischemia develops.

Ischemia can decrease the heart's pumping ability, because the heart muscle is weakened due to a lack of food and oxygen.

Unfortunately, you may not have any symptoms of beginning coronary artery disease, yet the disease will continue to progress until sufficient artery blockage occurs, causing angina (chest pain or discomfort due to coronary artery disease).

Angina feelings include chest or arm pain, chest pressure, fatigue, indigestion, palpitations, and shortness of breath.

### Heart attack

If a coronary artery is completely closed by a blood clot, a myocardial infarction (heart attack) may occur. The blood clot may occur when a plaque (build-up of fatty tissue inside the artery walls) ruptures. If the blood flow cannot be restored quickly to the particular area of the heart muscle affected, the tissue dies.

### Reasons for the Procedure

PTCA is performed to restore coronary artery blood flow when the narrowed artery is in a location that can be reached in this manner. Not all coronary artery disease can be treated with

PTCA.

Your physician will decide the best treatment of your CAD based on your individual circumstances. There may be other reasons for your physician to recommend a PTCA.

### **Risks of the Procedure**

Possible risks associated with PTCA, atherectomy, and/or stent include, but are not limited to, the following:

- bleeding at the catheter insertion site (usually the groin, but the arm may be used in certain circumstances)
- blood clot or damage to the blood vessel at the insertion site
- blood clot within the vessel treated by PTCA/stent
- infection at the catheter insertion site
- cardiac dysrhythmias/arrhythmias (abnormal heart rhythms)
- myocardial infarction
- chest pain or discomfort
- rupture of the coronary artery, requiring open-heart surgery

The amount of radiation used in fluoroscopy during a PTCA or stent procedure is considered minimal; therefore, the risk for radiation exposure is very low.

If you are pregnant or suspect that you may be pregnant, you should notify your physician due to risk of injury to the fetus from a PTCA. Radiation exposure during pregnancy may lead to birth defects. If you are lactating, or breastfeeding, you should notify your physician.

There is a risk for allergic reaction to the dye. Patients who are allergic to or sensitive to medications, contrast dye, iodine, or shellfish should notify their physician. Also, patients with kidney failure or other kidney problems should notify their physician.

For some patients, having to lie still on the procedure table for the length of the procedure may cause some discomfort or pain.

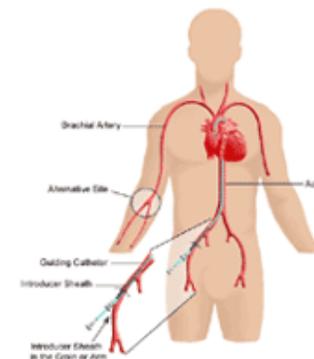
There may be other risks depending upon your specific medical condition. Be sure to discuss any concerns with your physician prior to the procedure.

### **Before the Procedure**

- Your physician will explain the procedure to you and offer you the opportunity to ask any questions that you might have about the procedure.
- You will be asked to sign a consent form that gives your permission to do the test. Read the form carefully and ask questions if something is not clear.
- Notify your physician if you have ever had a reaction to any contrast dye, or if you are allergic to iodine or seafood.
- Notify your physician if you are sensitive to or are allergic to any medications, latex, tape, and anesthetic agents (local and general).
- You will need to fast for a certain period of time prior to the procedure. Your physician will notify you how long to fast, whether for a few hours or overnight.
- If you are pregnant or suspect that you may be pregnant, you should notify your physician.
- Notify your physician if you have any body piercings on your chest and/or abdomen.
- Notify your physician of all medications (prescription and over-the-counter) and herbal supplements that you are taking.

- Notify your physician if you have heart valve disease, as you may need to receive an antibiotic prior to the procedure.
- Notify your physician if you have a history of bleeding disorders or if you are taking any anticoagulant (blood-thinning) medications, aspirin, or other medications that affect blood clotting. It may be necessary for you to stop some of these medications prior to the procedure.
- Your physician may request a blood test prior to the procedure to determine how long it takes your blood to clot. Other blood tests may be done as well.
- Notify your physician if you have a pacemaker.
- You may receive a sedative prior to the procedure to help you relax.
- The area around the catheter insertion (groin area) may be shaved.
- Based upon your medical condition, your physician may request other specific preparation.

### During the Procedure



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A PTCA may be performed as part of your stay in a hospital. Procedures may vary depending on your condition and your physician's practices.

Generally, a PTCA follows this process:

1. You will be asked to remove any jewelry or other objects that may interfere with the procedure. You may wear your dentures or hearing aid if you use either of these.
2. You will be asked to remove clothing and will be given a gown to wear.
3. You will be asked to empty your bladder prior to the procedure.
4. An intravenous (IV) line will be started in your hand or arm prior to the procedure for injection of medication and to administer IV fluids, if needed.
5. You will be placed in a supine (on your back) position on the procedure table.
6. You will be connected to an ECG monitor that records the electrical activity of the heart and monitors the heart during the procedure using small, adhesive electrodes.

Your vital signs (heart rate, blood pressure, breathing rate, and oxygenation level) will be monitored during the procedure.

7. There will be several monitor screens in the room, showing your vital signs, the images of the catheter being moved through the body into the heart, and the structures of the heart as the dye is injected.
8. You will receive a sedative medication in your IV before the procedure to help you relax. However, you will likely remain awake during the procedure.
9. Your pulses below the insertion site will be checked and marked so that the circulation to the limb below the site can be checked after the procedure.

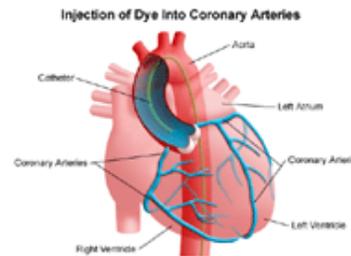
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10. A local anesthetic will be injected into the skin at the insertion site. You may feel some stinging at the site for a few seconds after the local anesthetic is injected.
11. Once the local anesthetic has taken effect, a sheath, or introducer, will be inserted into the blood vessel. This is a plastic tube through which the catheter will be inserted into the blood vessel and advanced into the heart.

If the arm is used, a small incision (cut) may be made to expose the blood vessel for insertion of the sheath.

12. The angioplasty catheter will be inserted through the sheath into the blood vessel. The physician will advance the catheter through the aorta into the heart. Fluoroscopy will be used to assist in advancing the catheter to the heart.
13. The catheter will be advanced into the coronary arteries. Once the catheter is in place, contrast dye will be injected through the catheter into your coronary arteries in order to see the narrowed area(s).

You may feel some effects when the contrast dye is injected into the IV line. These effects include a flushing sensation, a salty or metallic taste in the mouth, and/or a brief headache. These effects usually last for a few moments.



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14. You should notify the physician if you feel any breathing difficulties, sweating, numbness, itching, nausea and/or vomiting, chills, or heart palpitations.
15. After the contrast dye is injected, a series of rapid, sequential x-ray images of the heart and coronary arteries will be made. You may be instructed to take in a deep breath and hold it for a few seconds during this time.
16. When the physician locates the narrowed artery, the catheter will be advanced to that location and the balloon will be inflated to open the artery.

It is possible to experience some chest pain or discomfort at this point as a result of blood flow being temporarily blocked by the inflated balloon. Any chest discomfort or pain should go away when the balloon is deflated.

However, if you notice any continued discomfort or pain, such as chest pain, neck or jaw pain, back pain, arm pain, shortness of breath, or breathing difficulty, tell your physician immediately.

17. The physician may inflate and deflate the balloon several times. The decision may be made at this point to insert a stent in order to maintain the artery's opening. In some cases, the stent may be inserted into the artery before the balloon is inflated. The inflation of the balloon will open the artery and fully expand the stent.
18. The physician will take measurements after the artery has been opened. Once it has been determined that the artery is opened sufficiently, the angioplasty catheter will be removed.
19. The insertion site may be closed with a closure device that uses collagen to seal the opening in the artery, by the use of sutures, or by applying manual pressure over the area to keep the blood vessel from bleeding. Your physician will determine which method is appropriate for your condition.

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20. If a closure device is used, a sterile dressing will be applied to the site. If manual pressure is used, the physician (or an assistant) will hold pressure on the insertion site so that a clot will form.

Once the bleeding has stopped, a very tight bandage will be placed on the site. A small sandbag or other type of weight may be placed on top of the bandage for additional pressure on the site, especially if the site is in the groin.

21. Your physician may decide not to remove the sheath, or introducer from the insertion site for approximately four to six hours, in order to allow the effects of blood-thinning medication given during the procedure to wear off.

You will need to lie flat during this time. If you become uncomfortable in this position, your nurse may give you medication to make you more comfortable.

22. You will be assisted to slide from the table onto a stretcher so that you can be taken to the recovery area. NOTE: If the insertion was in the groin, you will not be allowed to bend your leg for several hours.

To help you remember to keep your leg straight, the knee of the affected leg may be covered with a sheet and the ends tucked under the mattress on both sides of the bed to form a type of loose restraint.

If the insertion site was in the arm, your arm will be kept elevated on pillows and kept straight by placing your arm in an arm guard (a plastic arm board designed to immobilize the elbow joint).

In addition, a plastic band (works like a belt around the waist) may be secured around the arm near the insertion site. The band will be loosened at given intervals and then removed at the appropriate time determined by your physician.

## After the Procedure

### In the hospital

After the procedure, you may be taken to the recovery room for observation or returned to your hospital room. You will remain flat in bed for several hours after the procedure. A nurse will monitor your vital signs, the insertion site, and circulation/sensation in the affected leg or arm.

You should immediately inform your nurse if you feel any chest pain or tightness, or any other pain, as well as any feelings of warmth, bleeding, or pain at the insertion site in your leg or arm.

Bedrest may vary from two to six hours depending on your specific condition. If your physician placed a closure device, your bedrest may be of shorter duration.

In some cases, the sheath or introducer may be left in the insertion site. If so, the period of bedrest will be prolonged until the sheath is removed. After the sheath is removed, you may be given a light meal.

You may feel the urge to urinate frequently because of the effects of the contrast dye and increased fluids. You will need to use a bedpan or urinal while on bedrest so that your affected leg or arm will not be bent.

After the specified period of bed rest has been completed, you may get out of bed. The nurse will assist you the first time you get up, and will check your blood pressure while you are lying in bed, sitting, and standing. You should move slowly when getting up from the bed to avoid any dizziness from the long period of bedrest.

You may be given pain medication for pain or discomfort related to the insertion site or having to

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lie flat and still for a prolonged period.

You will be encouraged to drink water and other fluids to help flush the contrast dye from your body. You may resume your usual diet after the procedure, unless your physician decides otherwise.

You will most likely spend the night in the hospital after your procedure. Depending on your condition and the results of your procedure, your stay may be longer. You will receive detailed instructions for your discharge and recovery period.

## At home

Once at home, you should monitor the insertion site for bleeding, unusual pain, swelling, and abnormal discoloration or temperature change at or near the insertion site. A small bruise is normal. If you notice a constant or large amount of blood at the site that cannot be contained with a small dressing, notify your physician.

If your physician used a closure device for your insertion site, you will be given specific information regarding the type of closure device that was used and how to take care of the insertion site. There will be a small knot, or lump, under the skin, where the insertion site was.

This is normal. The knot should gradually disappear over a few weeks.

It will be important to keep the insertion site clean and dry. Your physician will give you specific bathing instructions.

You may be advised not to participate in any strenuous activities. Your physician will instruct you about when you can return to work and resume normal activities.

Notify your physician to report any of the following:

- fever and/or chills
- increased pain, redness, swelling, or bleeding or other drainage from the insertion site
- coolness, numbness and/or tingling, or other changes in the affected extremity
- chest pain/pressure, nausea and/or vomiting, profuse sweating, dizziness, and/or fainting

Your physician may give you additional or alternate instructions after the procedure, depending on your particular situation.