

Cardiac Catheterization

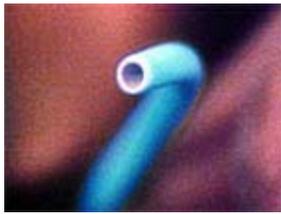
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For almost a half-century, cardiac catheterization, or selective coronary angiography, has been the "gold standard" of imaging tests for determining the nature of coronary artery disease since its "accidental" discovery in 1958 by Dr. Mason Sones of the Cleveland Clinic.

Prior to the recent development of MultiSlice CT angiography, catheterization was the only way to directly image the coronary arteries and identify areas of narrowing or blockage (technical term: stenosis). If the cardiologist determines that an intervention, such as an angioplasty or stent, can benefit the patient, cardiac catheterization is the imaging mode that must be used for that intervention.



Dr. Mason Sones discovers coronary angiography



Tip of a hollow coronary catheter

Utilizing long, flexible, hollow tubes, called catheters, physicians have been able to transform the circulatory system of the body into a "highway", and use it to deliver specialized tools and medicines to diagnose and treat heart disease non-surgically.

The entrance to the arterial "highway" is through a needle puncture, usually made in the groin (femoral) artery. Some physicians have been specially trained to use the wrist (radial) artery, which is possible in certain patients and has an advantage of speedier recovery. Because catheters and devices are actually inserted inside the body, cardiac catheterization is the only imaging test that can be called "invasive".

Catheter-based procedures are performed in a special room in the hospital: the catheterization, or "cath", lab. The room is outfitted with high-resolution imaging equipment.

This typically has been a combination fluoroscopic (X-ray) video and film system that allowed the cardiologist to see in real time what he was doing inside the body. In recent years, cath labs have become all-digital and now feature very sophisticated higher-resolution, finer contrast and lower X-ray dose technology, called Flat Panel Detector, or FPD.



Infinix-i Catheterization Imaging System**



Cardiologist talking to patient during angiogram

Just before a coronary angiogram, the patient is given light sedation for comfort, but remains awake during the procedure in order to respond to various instructions ("*take a deep breath*", "*hold your breath*", "*cough*", etc.) from the interventional cardiologist who is part operator, part diagnostician, part photographer.

The first step is a diagnostic picture of the arteries, called a coronary arteriogram, angiogram or catheterization. The needle puncture is made, using a local anesthetic. The physician then threads a catheter through the entry site and follows the main artery in the body, called the aorta, up and around into the opening of the left, or right, coronary artery.

Through this hollow catheter, the physician injects a small amount of special dye, called contrast, which, when viewed in motion under X-rays, reveals any obstructions or plaques located within the coronary vessels. When the dye is injected, the patient may feel a warm sensation. Views from several camera angles are recorded. A different catheter is directed into the heart chamber and dye is injected into the ventricle, making a ventriculogram, which shows the movement and efficiency of the heart muscle.

Depending on the number, severity and location of these obstructions, the physician may refer the patient for medical therapy, bypass surgery, or, if appropriate, treat the patient directly, using catheter-based techniques.

If the likelihood of coronary blockage was considered high going into the angiogram, then the patient may have been scheduled for a "cath possible", short-hand for "catheterization with a possible angioplasty and stent". In this case, the cardiologist transforms the diagnostic test on the spot into a therapeutic procedure. Since the arterial "highway" has already been

actual fluoroscopic image of blocked artery



traversed with a catheter and guide wire, an angioplasty balloon and stent can readily be advanced to the blockage and inflated, adding only about an hour to the session. For more information on this, visit www.angioplasty.org/angio101.



*artist's rendering of same
blocked artery*

Whether or not an angioplasty is performed, the puncture site in the femoral artery must be closed. This can be done with manual compression, which requires the patient to lie still afterward for many hours while the puncture site heals. Often small vascular closure devices are used to seal or close the femoral puncture site. These can be collagen-based (Angioseal, Vasoseal) where a "plug" of bovine collagen is placed against the artery to form a seal, or the newest device which is a nitinol clip (Starclose) and works almost like a grommet punch. The pros and cons of these various closure methods should be discussed with the physician beforehand.

As with any invasive procedure, there are some risks to a cardiac catheterization, although they are rare. The patient may be allergic to the contrast dye – this should be discussed with the physician before the catheterization. There is a very slight chance of heart attack or stroke. The most common complications occur around the femoral puncture site. They are less than 3%. Most common is a hematoma, a bleeding under the skin from a small leak in the closed artery. Hematomas usually resolve themselves and the bruising appearance disappears after a few weeks. A larger hematoma, or a pseudo-aneurysm which is a swelling out of the artery, may require further treatment. A rare but significant complication is trauma or damage to the femoral nerve, which runs alongside the femoral artery. If you experience any complications after your angiogram, contact your doctor.

Whether you should be having a cardiac catheterization, or whether one of the non-invasive imaging procedures like MultiSlice CT angiography might be a better screening tool, is a subject each patient needs to discuss with his or her cardiologist. Recent studies have shown a cost-risk benefit to the non-invasive tests for certain patient populations.

Who Does the Procedure: Cardiac catheterizations are performed by an interventional cardiologist with his or her cath lab team of four or more: usually a nurse or two, a cardiovascular technologist, possibly a physician's assistant or fellow. Be sure to let the nurse or physician know if you experience anything out of the ordinary.

Patient Preparation: Don't eat or drink for six to eight hours before the angiogram. Make sure your doctor or nurse practitioner knows ahead of time all the medications you are currently taking in case one needs to be stopped. Also tell your doctor if you are diabetic or have allergies of any sort. Once admitted, you'll be given some standard checks and the area around the puncture site will be shaved. Every hospital has their own protocol. It's very helpful if you have a family member or friend with you. A simple angiogram is usually done as an outpatient procedure and you will go home the same day.

**** photo courtesy of Toshiba America Medical Systems**

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