Anatomy

Blood vessels are tube-like channels running throughout the body. There are two major types of blood vessels. Arteries carry blood away from the heart. Veins carry blood to the heart. Arterial blood provides oxygen and nutrients to the tissues and muscles of the body. The aorta, which comes directly off the heart, is the largest artery of the body. It has many branches that supply blood to all parts of the body (Figure B, page 3).

Arterial Disease

Arterial disease refers to changes or disorders in the arteries that prevent normal blood flow. The two main types of arterial disease are occlusive disease (narrowing of the artery) and aneurysm disease (enlarging of artery).

A major cause of arterial disease is atherosclerosis. This is a slow process in which deposits of fat, cholesterol, and calcium build-up inside the artery. These deposits are called plaque. Like the inside of a rusty water pipe, the wall of the artery becomes rough, hard, and more narrow (Figure A).
Atherosclerosis mainly affects the main blood vessels of the body, but it occurs to some extent in all arteries. If the aorta, the iliac and femoral arteries become blocked, blood flow to the legs decreases (Figure A). Arteries supplying blood to the kidneys and intestines can also become diseased.

Aneurysms occur when the wall of the artery weakens and swells like a balloon. They are often found in the abdominal aorta (the large main artery down the middle of the body) and also occur in the iliac, femoral and popliteal arteries. If an aneurysm is not repaired, rupture of the aneurysm or blockage within the aneurysm may occur (Figure A). This is a life and/or limb-threatening condition.

Blood clots may also cause the artery to narrow. Platelets, found in the blood, may attach to the rough surface of the artery, clump together and form a blood clot (thrombus). These blood clots also form in the heart and in aneurysms. At anytime, a clot can break off and lodge in an artery and obstruct blood flow. This is called an embolus (Figure A).

**Risk Factors**

Risk factors are habits, traits or conditions that may increase a person’s chance of developing atherosclerosis. Risk factors for cardiac and vascular disease that cannot be changed include:

- Family history of arterial or aneurysm disease.
- Age.
- Gender (male or post-menopausal female).

Risk factors that can be controlled or modified include:

- Cigarette smoking
- Excess weight
- High blood pressure
- Stress
- High blood cholesterol
- Lack of exercise
- Diabetes
- Blood clotting disorders

**Symptoms**

When a blockage occurs in an artery to the legs, the following may occur:

- Pain in calves, thighs, and/or buttocks during walking (relieved with rest).
- Pain at rest (with severe blockage).
- Skin discoloration.
- Coolness of the legs.
- Loss of hair on toes, feet and legs.
- Thickening of toenails.
- Tingling, numbness.
- Ulcers or gangrene.
- Impotence in men.

Normal arteries are elastic; they widen and narrow depending on the demand for blood flow. During exercise, there is an increased demand for oxygen in the leg muscles. However, blocked or damaged vessels are not able to vary the amount of blood they deliver. Thus, these vessels fail to supply the tissues with the added oxygen needed during exercise and pain occurs.

A sudden blockage in an artery may cause the following to occur in the leg or legs:
- Pain.
- Paleness or whiteness.
- No pulse.
- Numbness or tingling.
- Coolness.
- Paralysis (cannot move).

A blockage in an artery to the kidney may cause high blood pressure and kidney failure.

A blockage in an artery to the intestines may cause:
- Abdominal pain after eating.
- Weight loss.
- Sudden, severe onset of abdominal pain (with a sudden artery blockage).

Aneurysms may not produce any symptoms; however, if symptoms are present, they may include:
- Abdominal pain.
- Back pain.
- Scrotal pain.
- Pulsating mass in the abdomen.
- Blue toes.

In most patients with severe arterial disease or aneurysms, surgery is the treatment of choice.
Diagnostic Tests

In preparing for surgery, you will need certain tests. The basic tests include blood work, urinalysis, chest x-ray and electrocardiogram. Other tests may include the following.

**Angiogram:** This is an x-ray study, which outlines the blood vessels to the legs. It is used to find the exact location and extent of any blockage or narrowing of an artery.

**Magnetic Resonance Angiogram (MRA):** An MRA also is used to find the exact location and extent of any blockage or narrowing of an artery. The testing and recovery time is less than that of a routine angiogram.

**CT scan (Computerized Tomography):** This test uses a computer to examine the inside of your body. The images it produces are “cross-sectional planes” taken from a part of your body, much like slices taken out of a loaf of bread. Such an image provides the needed detail regarding arterial disease.

**Arterial Blood Flow Test:** This test measures blood flow in the arteries. It helps detect a blockage in blood flow (blood clot, narrow vessel). If blockages are found, the exam tells us where and how severe the blockages are. This test is done before and after surgery and on a regular basis after discharge from the hospital.

**Duplex Scanning:** This test produces an image of an artery, bypass graft or vein which may be used for bypass grafting. It measures the size of the blood vessel, as well as its blood flow.

Written instructions for these tests are available. If you have not received them, please ask.

Preoperative Concerns

**Risk**

There is some risk with every operation. The risk varies with each person, depending on the artery disease and the type of surgery. Although rare, bleeding, blockage of the bypass graft, infection, and heart problems kidney failure, and bowel obstruction may occur after surgery. These problems may require more surgery. Your surgeon discusses with you the benefits and risks of your surgery.

**Postponement**

Surgery is sometimes postponed due to another patient needing emergency surgery, or if you develop a fever, sore throat or cold. You are told of any delay as soon as possible. Surgery is postponed only when absolutely necessary.

**Research Studies**

Northwestern Memorial Hospital is affiliated with Northwestern University Medical School, which is involved in a variety of research studies. If you are asked to take part in one of these studies, the decision is yours. Please ask your doctor if you have any questions.
Surgery

Aortic surgery is done to restore blood flow to the legs, kidneys and intestines. For an aneurysm, surgery prevents rupture or clotting within the aneurysm. No medicine can treat these problems. Early treatment can avoid complications.

Surgery may involve:
- Removing the plaque (endarterectomy).
- Removing a blood clot from an artery or bypass graft (thrombectomy or embolectomy).
- Placing a bypass around a blockage in the artery.

An artificial graft is used to bypass the narrow area or replace the weak walls of an aneurysm. One end of the graft is sewn to the aorta above the affected area. The other end is sewn below it. The graft is made out of a synthetic (man-made) material. Synthetic grafts are not rejected by the body, but they can become infected. (Samples of the graft are on hand if you would like to see one.)

Figure C will help you understand the location of the problem and graft placement. Surgery of the aorta takes about four hours under general anesthesia.

Figure C
After Surgery

Most patients spend one night in the ICU (Intensive Care Unit) after surgery. You may have a nasogastric (NG) tube inserted at the time of surgery to keep the stomach empty and prevent nausea and vomiting. This tube is kept in for about 2 to 4 days. When it is removed, you will start with a clear liquid diet and slowly advance to solid food.

You will have a catheter in your bladder to monitor your urine output. Your weight is also checked. People may gain several pounds of water weight during the surgery that will be lost over the next several days.

The day after surgery, a physical therapist (PT) will be in to see most patients. The PT will teach you exercises to improve your strength and mobility.

Home Care Services

Some patients may need rehabilitation or a skilled nursing facility after their hospital stay. As needed, a social worker assists you and your family with these arrangements.

If you need skilled nursing care, physical therapy or help at home after discharge from the hospital, this may be arranged through Northwestern Memorial Home Health Care. Please tell your nurse if you are interested in this service.

Discharge

Depending on the extent of their surgery, most patients stay in the hospital 5 days. Discharge time is 11 am.

Taking Care After Surgery

Activity

Recovery from surgery varies with each person and on the type of surgery. You may tire easily. Allow for rest periods. Let your body be your guide. Return to your normal level of activity at a gradual but regular pace using common sense. No heavy lifting (more than 10 lbs.) for one month after surgery.

Regular exercise is important. Walking promotes blood flow and muscle tone, along with a feeling of well-being. If you are interested in taking part in a vascular rehabilitation program (an exercise program), talk with your doctor.

You may go outdoors and also climb stairs. Do not be afraid to bend your knee or straighten your leg. When walking, place your feet flat on the floor. If leg swelling occurs, elevate your legs when sitting.

If you feel good and well rested, sexual activity can be resumed in two to three week after being home.
**Driving**
You may drive a car when you are free of pain and are able to move your legs comfortably. Do not drive after taking narcotic pain medicine or sleeping pills.

**Work**
If you wish to return to work before your first medical check-up, please call your doctor. This depends on your job and its demands.

**Diet**
Loss of appetite and changes in your bowel habits may occur. They should return to normal within a few weeks. Eat a balanced diet; it is important for wound healing. A dietitian will instruct you and your family about any diet therapy requested by your doctor.

**Medication**
Take any needed medicines as directed by your doctor. Your doctor, nurse or pharmacist will give you specific instructions. They are happy to answer any questions.

**Bathing**
Bathing, showering, and washing your hair is allowed about the fifth day after surgery. Clean the incision gently with mild soap and water. Dry the incision well.

**Wound Care**
No special wound care is usually needed. Bruising and skin discoloration are normal and disappear in time. If oozing from the incision occurs, apply Betadine® if no allergy exists. Then cover the wound with a dry gauze pad. If stitches are internal, they do not need removal. If they are external, your doctor will give you a date for their removal. You do not need to replace any adhesive strips that come off your incision. Do not use adhesive or paper tape on your lower leg. It is normal to have some incision discomfort; this will gradually disappear.

**Elastic Support**
Leg swelling may occur after surgery. Because you are less active, fluid can more easily collect in the lower legs. Your doctor may order elastic bandages for you. The pressure they provide helps the leg muscles to propel blood toward the heart. This decreases fluid build-up in the legs. Wear four-inch elastic bandages on the affected leg when you are walking or sitting. Apply bandages before walking to avoid leg swelling. Wrap the bandages snugly from the toe to just below the knee. Overlap the edges of the bandage. The bandages may be removed at night. Your nurse will show you how to apply the bandages before you leave the hospital (Figure D).
You should wear elastic bandages at home for about two weeks or until swelling in the lower legs is gone. If swelling or discomfort persists, continue to wear the bandages for support. If you are in doubt, ask when you return for your medical check-up. Elastic bandages can be washed with mild soap and water and reused. Be sure to dry thoroughly. Extra bandages can be obtained before discharge from the hospital and at most drug stores.

**Clothing**

Do not wear clothes such as tight socks, garters, or panty hose that can constrict the legs or feet. Wear shoes that fit well. Ill-fitting shoes cause pressure, tenderness, and swelling in the feet. Break in new shoes slowly. Always wear stockings with shoes to prevent blisters. Wear clean socks daily.

**Foot Care/Avoiding Injury**

Care of the skin on the feet and legs is very important. Your feet may develop problems more easily than those of people with normal circulation.

- Wash your feet each day and dry them well.
- Inspect your feet and legs daily for new sores, cracking skin, and changes in skin color. Use a mirror or ask a family member/friend if you are unable to do so.
- If a sore develops, contact your doctor. See a podiatrist if you have corns, calluses, or ingrown toenails.
- Keep pressure off your heels when lying in bed for extended periods of time.
- Test bath water with hands and not with your toes. Water should be lukewarm (body temperature).
- Avoid hard rubbing of the skin, such as scratching insect bites.
- Use electric razors when shaving your legs.
Avoid cream hair removers because of the harsh chemicals they contain.
- Protect your feet from extreme heat or cold.
- Avoid heating pads, heat lamps, and hot water bottles on your feet or the affected area of your legs.
- Avoid walking barefoot.
- Inspect your shoes before putting them on to check for objects that could cause injury to your feet.

**Prevention of Infection**

If you have an artificial graft, antibiotics may be needed prior to surgery and before certain types of dental procedures. Tell your dentist or doctor about the artificial graft, so needed antibiotics may be given. This helps prevent a possible graft infection.

**Reducing Your Risk Factors**

Atherosclerosis cannot be cured, but taking steps to reduce your risk factors may prolong and improve quality of life, along with decreasing the need for angioplasty or more surgery.

To control atherosclerosis, it is important to make the following lifestyle changes:
- Control hypertension, diabetes and high blood cholesterol.
- Stop smoking.
- Exercise regularly.
- Reduce stress in your life.
- Modify your diet (see Diet section, page 11).

Talk with your doctor about taking aspirin, statin medicines (for lowering cholesterol) and useful vitamins.

Northwestern Memorial Hospital provides brochures on risk reduction topics including:
- *Heart Healthy Nutrition (discusses the Therapeutic Lifestyle Change, TLC, Guidelines)*
- *Modify Your Lifestyle to Reduce Your Risk of Heart & Vascular Disease*
- *Cardiac & Vascular Resources & Support Services*

Please ask your nurse for a copy of these brochures if you have not received them.

While in the hospital, The Northwestern Video On-Demand system has videos that have helpful information about lifestyle modification. Dial 6-2585 on your telephone or your nurse can help you use the system. Some important titles include:
Order # Title
362 Healthy Eating for Life
163 High Blood Pressure: An Introduction to Treatment
169 Beginning a Cardiac Rehabilitation
364 Smoking: Getting Ready to Quit
530 Understanding Anticoagulant Medications
121 Rhythmic Medicine
122 Relaxing Through the Seasons

Write down and ask questions. If you are unsure of what to ask, talk to your nurse.

These same videos are also found in the Health Learning Center (3rd Floor of the Galter Pavilion). After discharge, consider visiting the Center. It has a wealth of both print and electronic health information resources. If you are unable to visit in person, the staff can assist by telephone (312-926-LINK) or email (hlc@nmh.org). You may also visit us at www.nmh.org.

Talk to your medical doctor about the American Heart Association (AHA) guidelines for coronary and vascular disease risk reduction. The following are some of the brochures that can be obtained from the American Heart Association (1-800-242-8721).

- A Guide to Losing Weight
- Recipes for Low Fat, Low Cholesterol Meals
- How to Read the New Food Label
- High Blood Pressure

**Diet**

The American Heart Association suggests a diet low in cholesterol and fats. Dietary cholesterol may increase the blood cholesterol that may cause atherosclerosis. Keep in mind is that food products from animal sources contain cholesterol. The following are some suggestions to help control your intake of cholesterol.

- Use fish, chicken, turkey or veal for most of your meals; use beef, lamb, or pork less often.
- Use lean cuts of meat, trim visible fat, and do not use the fat drippings.
- Limit use of organ meats (liver, brains, kidneys, sweetbreads) to once a month.
- Use only two to three egg yolks per week, including eggs used in baking.
- Use polyunsaturated oils, such as safflower, corn, soybean, cottonseed, sunflower seed, or sesame oil.
- Use margarine made from polyunsaturated oil instead of butter.
Use skim milk and skim milk cheese instead of whole milk and whole milk cheese.
- Eat sherbet or flavored ice instead of ice cream.

If needed, a dietitian can help you plan a weight reduction program before your discharge.

**Smoking**

NO SMOKING! Nicotine in cigarettes causes the arteries to narrow, which decreases blood flow. Smoking also speeds up the heart rate and increases blood pressure. Northwestern Memorial Hospital offers a stop smoking clinic. Call 312/926-9355 for information.

**Alcohol**

One drink for women or two drinks for men daily appear to cause no harm in adults. If you drink, you should do so in moderation. DO NOT mix alcohol with tranquilizers, sleeping pills, or pain medications.

**Stroke Prevention**

Atherosclerosis is a disease that affects many arteries in the body. Stroke can be a result of carotid artery disease.

The warning signals of a stroke are:

- Sudden weakness or numbness of the face, arm or leg on one side of the body.
- Sudden dimness or loss of vision, particularly in only one eye.
- Loss of speech, or trouble talking or understanding speech.
- Sudden, severe headaches with no known cause.
- Unexplained dizziness, unsteadiness or sudden falls, especially along with any of the previous symptoms.

If any of the above symptoms occur and then go away, DO NOT IGNORE THEM. Report them to your doctor.

**Follow-up Care**

If you are diabetic or have high blood pressure, continue with prescribed treatment. Notify your doctor if any of the following occurs:

- Changes in your incision, such as new or unusual drainage, or change in color, odor, or amount of drainage.
- Fever over 100° F.
- Increase in temperature, swelling, inflammation (redness) or tenderness around the incision.
- Unusual or severe increase in pain in the abdomen or legs.
- Sudden weight gain or swelling of the feet, ankles or legs.
- Loss of sensation or movement of legs, unusual tingling.
- Coldness or discoloration of legs.

It is important to keep your follow-up doctor’s appointment, even if you are feeling well. Make the appointment for two to three weeks after discharge from the hospital. Please call if you have questions before that time.

To detect any problems early, it is important that you have an arterial blood flow test of your legs six months after surgery and once a year after that. You are due to have this test in _______________________.

Please call the Vascular Laboratory at Northwestern Memorial Hospital (312-926-2746) to schedule this appointment.

Physician: ________________________________________________________________

Phone Number: __________________________________________________________

Office location: ___________________________________________________________

Advanced Practice Nurse: _________________________________________________

Phone Number: __________________________________________________________

**Health Information Resources**

For more information, visit one of Northwestern Memorial Hospital’s Health Learning Centers. These state-of-the-art health libraries are located on the third floor of the Galter Pavilion and on the first floor of the Prentice Women’s Hospital. Health information professionals are available to help you find the information you need and provide you with personalized support at no charge. You may contact the Health Learning Centers by calling 312-926-LINK (5465) or by sending an e-mail to hlc@nmh.org.

For additional information about Northwestern Memorial Hospital, please visit our Web site at www.nmh.org.